1892

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MYOTOMIA
REFORMATA

MYOTOMIA REFORMATA:

OR AN

ANATOMICAL TREATISE ON THE MUSCLES OF THE HUMAN BODY.

Illustrated with FIGURES after the LIFE.

By the late Mr. WILLIAM COWPER,
Surgeon, and Fellow of the Royal Society.

To which is prefix'd
An INTRODUCTION
CONCERNING
MUSCULAR MOTION.

LONDON:

Printed for ROBERT KNAPLOCK, and WILLIAM and JOHN INNYS, in St. *Paul's Church-Yard*; and JACOB TONSON, in the *Strand.* MDCCXXIV.

ADVERTISEMENT.

IT is a Matter of no Importance to the Publick, to be acquainted with the Reafons why the printing of this Work has been delayed for fo long a time as thirteen Years fince the Death of the Author; but the Reader may expect to be informed in what Condition it was left by Mr. Cowper, and by what Care and Pains it has been brought into the Form, in which it now appears.

THE Author had finifhed the Plates of this Book a little before his Death, and was preparing to put in order the Text, when he found his Weaknefs, occafioned by frequent Fits of an Afthma, which had brought him into a Dropfy, to grow upon him fo faft, that he fhould not be able to complete his Defign. He therefore refolved to retire and end his Days in the Country, having firft delivered his Papers into my Hands, and defired me, with the Affiftance of his intimate Friend Mr. Joseph Tanner, an ingenious Anatomift and skilful Surgeon, to take Care of the Publication of his Book.

THE Method Mr. Cowper had taken in this Work was to put down from time to time, in an interleav'd Copy of the Treatife he formerly publifhed on the Mufcles, fuch Alterations and Additions as he thought proper. But it required a finifhing Hand to connect and digeft all thefe into right Order: This Task has been performed by the learned Dr. Jurin, Secretary to the Royal Society, who thought himfelf obliged to preferve not only the Meaning, but alfo, as much as was poffible, the Words of the Author; although Mr. Cowper had always greater Regard to the Truth of his Defcriptions, than to the Eafinefs and Politenefs of his Style.

THE Author's Preface ends abruptly, and is otherwife defective; for befides the Additions, which are here made to the Preface of his former Book, he intended fome others; particularly there were found in his Papers a few Sketches concerning the Ufefulnefs of Anatomy in Painting and Statuary; but thefe were fo imperfect, that they were not fit to be printed.

THE

THE Introduction concerning Mufcular Motion is not the fame with that, which was prefixed to the former Book; though Care has been taken here to preferve whatever Difcovery in Anatomy was contained in that. Mr. COWPER was fo fenfible of the Defects of his own Performance on that Head, that he engaged me to get fomething more full fubftituted in its room. I have been inabled to make good this my Promife, by the Affiftance of my Friend Dr. H. PEMBERTON, who is no lefs skill'd in Mathematicks and Philofophy, than in Anatomy and whatever relates to the Animal Oeconomy.

AS the Character of Mr. COWPER, who was univerfally allowed to be as eminent an Anatomift as any of his Time, will fufficiently recommend this Work, fo I am perfuaded it may be faid to have loft nothing by the other Hands, through which it has paffed: And certainly it will be no fmall Satisfaction to all who may have a Concern for the Memory of the Author, that although this Work has been long expected, yet nothing has in all this time appeared, which can render it lefs ufeful or acceptable to the Publick: The Knowledge of the Human Body is indeed a large Field, which doubtlefs will continually reward the Labour of thofe, who cultivate it, with the Pleafure of new Difcoveries; and fome Improvements have been lately made in relation to the Mufcles; but no Book, that I know of, has in any Language been yet publifh'd on this part of Anatomy, that is fo complete as this Treatife; not but that this, like all other human Performances, may have its Imperfections, which will perhaps entertain the ill Nature of fuch Readers, who take more Pleafure in finding Faults, than they do in being inftructed.

Dec. 30. 1723.

RICHARD MEAD.

THE

PREFACE.

IN *the Contemplation of* Nature *we meet with nothing that affords us a more invincible Argument of the* Wisdom *of the* Divine Architect, *than the Structure and Composition of* Animal Bodies; *nor is this* Infinite Understanding *less manifested in the* Instruments *of* Voluntary Motion, *than in any other Parts whatever of the Animal Body.*

NO wonder therefore, that Anatomical Disquisitions *should be exceedingly entertaining; but besides it behoves* Philosophers, *who inquire into the Nature of Things, and* Physicians *especially,*

whose Province it is to preserve the Curious Fabric *of the* Human Body, *to acquaint themselves fully with the Nature and Constitution of that* Noble Subject; *for that is the only way to learn what are the secret Springs by which the mysterious Operations of* Sense *and* Motion *are performed, to discover by the Symptoms of* Diseases *the several* Causes *and* Seats *of them, together with the proper Methods for their* Prevention *and* Cure.

WHAT Esteem the Judicious have always had for Enquiries of this nature, we may learn from our Great Master HIPPOCRATES, *who was sent for to* DEMOCRITUS *the* Founder *of the* Mechanical Philosophy, *to cure him of his supposed Madness; and finding* DEMOCRITUS *dissecting the* Bodies of Animals *to discover the Seat of the* Bile, *and assign the Reasons of its Effects,* HIPPOCRATES *was so far from looking upon him to be mad, that he pronounced him one of the* Wisest of Men.

NOR is the Story that is told of our Modern Philosopher DES CARTES *less remarkable, who shew'd a Gentleman, that came to see his* Library, *nothing but a* Calf, *which he design'd to* dissect.

BUT it is needless at this time to enlarge either upon the Usefulness of Anatomy *in general, or the particular Advantages of an Exact Knowledge of* Myology, *in order to the* Practice *of* Chirurgery; *and therefore I shall wave what might be said upon those Heads, and only give a short History of the Advancements that have been made in* Muscular Anatomy *in several Ages, and the Reasons why I undertook to write upon that Subject.*

WITHOUT doubt HIPPOCRATES *was well skill'd in* Anatomy, *as appears by his Book* De Fracturis, *&c.*

ARI-

The PREFACE.

ARISTOTLE *dissected many* Animals *before he began to compose their History; and* DIOGENES LAERTIUS, *in his Life of this Philosopher, informs us, that he writ also a Treatise of* Anatomy, *tho' it be now lost.*

RUFFUS EPHESIUS *had also made some Progress herein, and gave the External Parts their proper Names.*

GALEN *and the* Anatomists *of his time were indefatigable in their* Anatomical Labours, *as appears not only from those excellent Books of his* Of Anatomical Administration, *and* Of the Use of the Parts; *but in that compendious System of the* Muscles *collected out of them by* ORIBASIUS. *After* GALEN *we find no considerable Progress made in* Anatomy, *till the Accurate* JACOBUS SYLVIUS *and* ANDREAS VESALIUS, *about the middle of the sixteenth Century.*

THERE were indeed, even before GALEN, *others who wrote of* Anatomy, *as* ALCMÆUS CROTONIATA, DIOCLES CHARYSTIUS, ERASISTRATUS, *and* HEROPHILUS, *of which the two latter are said to have taught* Anatomy *publickly, and to have dissected many hundreds of Human Bodies in* Greece, Syria *and* Ægypt. GALEN *was a Disciple of the last; but we have none of their Writings now extant. Besides these there are others mentioned by* GALEN, *as* LYCUS, QUINTUS, *who was* LYCUS's *Master,* MARIANUS, *and others; but we shall not repeat any more of their Names, since their Observations afford us no occasion to mention them hereafter.*

MANY Arabians *have also written on this Subject, of whom* AVICENNA *is esteemed the chief.*

SINCE the Restoration of Letters, MUNDINUS *is reckon'd the first* Anatomist, *whose Works are commented on by* JACOBUS BERENGARIUS CARPENSIS, *and* CURTIUS; *but neither of these furnish us with any Discoveries in* Myology.

GABRIEL

GABRIEL DE ZERBIS *is also mentioned, but his Writings are mostly collected from the Observations of others.*

NICOLAUS MASSA, *a* Physician *of* Venice, *not only writ an accurate and compendious* Introduction *to* Anatomy, *so far as it was known in his Time; but being himself a Dissecter of human Bodies, he corrected some Errors of former Anatomists.*

STEPHANUS RIVERIUS, *a* Chirurgeon, *made several Drawings of the Parts of human Bodies, he dissected; which were put forth by* CAROLUS STEPHANUS, *a* Physician, *with three Books of his own, in Folio, in the Year* 1545, *some time after the excellent Figures of* VESALIUS *had been published; but as these Figures, by reason of their great Stiffness, are no wise to be compared with those of* VESALIUS, *so we learn from the Preface, that they were drawn, before those others had seen the light,* viz. *in the Year* 1539.

JACOBUS SYLVIUS *was an accurate* Anatomist *of his Time: He wrote an admirable* Commentary *on* GALEN's *Book* Of the Bones, *and likewise against* VESALIUS, *in defence of* HIPPOCRATES *and* GALEN. *After his Death was published that incomparable Piece entituled* Isagoge Anatomica, *wherein he digested the* Muscles *and* Vessels *into order, which were treated of confusedly before by* GALEN, VESALIUS, COLUMBUS, *and* FALLOPPIUS, *and distinguished them by those Names that are still in use.*

BEFORE SYLVIUS, *or at the same time,* FERNELIUS *and* JOHANNES GUNTHERUS ANDERNACUS *were Cotemporaries; but neither of them have made any Improvements in the Knowledge of the* Muscles.

ANDREAS VESALIUS *began very young to examine the Parts of several Animals, in which Study by a wonderful*

Saga-

Sagacity and Peculiarity of Genius, *he made a ſwift and ſucceſsful Progreſs. He was Scholar to* Guntherus, *as we learn from two Treatiſes of the latter,* viz. *his* Inſtitution. Anatom. *and his Book* de Veteri & Nova Medicina; *and a Diſciple to* Sylvius, *as is acknowledged in the* Preface *to his firſt Impreſſion* De Fabrica Humani Corporis, *printed in the Year* 1543, *which Paſſage is left out in the ſecond, publiſhed in the Year* 1555. *And here it may not be amiſs to take notice by the by of another difference between theſe two Editions, to wit, that the Figures of the former are much finer, but the Deſcriptions are more correct in the latter.*

INDEED much is owing to this Great Man, whoſe Accounts of the Muſcles *as well as of all other Parts, that were known to him, are generally very faithfully delivered. He was Cotemporary with* Realdus Columbus, Gabriel Falloppius, Bartholomæus Eustachius, *and* Valverda, *all excellent* Anatomiſts, *eſpecially the three former; the firſt of which and* Cæsalpinus *ſtarted early Hints of their Knowledge of the* Circulation of the Blood; *which perhaps for ſome Reaſons they afterwards concealed.*

FALLOPPIUS *was a moſt accurate Diſſecter of the* Muſcles, *and was no mean Admirer of* Vesalius, *tho' he made ſeveral Corrections of his Deſcriptions of the Muſcles and other Parts, diſcovering ſeveral things that had eſcap'd that great Man's Obſervation.*

FROM theſe *the* Myology *has received its greateſt Improvements; and tho' there are divers others who have written on this Subject, yet none except* Hieronymus Fabricius ab Aquapendente, *and* Julius Casserius Placentinus, *have given any true Marks of their Knowledge herein.*

BOTH the Riolans *Pretenſions are great; but we trace them in* Falloppius.

The PREFACE.

THERE are divers others in repute with the Vulgar for their Descriptions of the Muscles, *amongst which* SPIGELIUS *is the chief; but there seems to be nothing extraordinary in his Book, besides the Figures of* JULIUS CASSERIUS PLACENTINUS, *some of which are very ill done. Since our last named Author, there has been nothing discover'd in* Myotomy, *except* M. DU VERNY's *Oblique Muscle of the Ear.*

THE Sculptures of BIDLOO *are not to be forgotten, since they express divers* Muscles, *and other Parts so near the Life.*

THE many that have lately written on this Subject, especially our English *Writers, have rather increas'd than diminished former Errors; and particularly that Treatise of Mr.* WILLIAM MOLINS, *and that most erroneous one of* JOHN BROWN, *are chiefly Collections of the Mistakes of others.*

THE greatest part of Books now extant are mere Copies, *or Extracts, and useless Rhapsodies* Originals *are few and rare;* Mankind *finding it much easier to transcribe and steal, than to invent and improve, though* Nature *affords an unexhaustible and yet hidden Treasure, sufficient to employ the Search and Industry of all the* Hands *and* Wits *in the World. One great Mistake has much obstructed the Advancement of true Knowledge, and that is a general Opinion, that the Senses are gross and ignoble, and that abstracted Contemplations are the Perfections of Human Nature; and so it comes to pass that* Man's *Mind is fed and pleased with Chimæra's and Shadows, instead of true substantial Knowledge, which is only to be learnt from the true Physical Examination of things by Sense and Experiment.*

IN the former Edition I gave the Figures of a few Muscles only, being either such as had not been before discovered, or at least not well express'd, in the Figures of VESALIUS, CASSERIUS *and other Authors: In this you have all the Muscles hitherto describ'd drawn* in situ, *with some Muscles I have discover'd since the*

the Publication of the former Edition. The Outlines of ſome of theſe Figures are drawn after RAFAEL, *Sir* PETER PAUL RUBENS, GUIDO RENI, Monſ. LE FAGE; *but the Muſcling is done after ſeveral Human Subjects, and not copied from any Anatomical Book whatever. All theſe Figures are engrav'd on Copper, and where the* Parts *they repreſent are very ſmall, there is a prickt Line continued from ſuch Parts of the Figure, to which the Characters or Arithmetical Numbers are affixed, that refer to the Explications; by which is avoided Confuſion on thoſe Plates. You'll ſometimes find the ſame External Muſcles repreſented in ſeveral Figures, but always in different Poſitions; and this I think cannot be unacceptable to ſome, whatever others may ſay of its being needleſs. That the External Muſcles are oftener the Subject of our Conſideration than the Internal, is ſufficiently known. Wherefore we cannot be over curious in repreſenting them in various Poſitions. But beſides the exact Knowledge of the External Parts, that's required in the Practice of Surgery, I am apt to think thoſe who bend their Studies to the admirable Arts of* Sculpture *and* Painting, *may receive ſome Hints at leaſt from theſe Anatomical Figures.*

BESIDES the Figures grav'd in Copper, to make the Anatomy as intelligible as I could, I have added Figures of the Muſcles, as they appear after Separation from the Body, with their Series of Fibres, as they are ſeen on their internal Surface. This was attempted by CAROLUS STEPHANUS *or rather* STEPHANUS RIVERIUS; *but with what Succeſs, may be ſeen by comparing what is there done with the Life.*

IN doing theſe Figures I was not contented to sketch them after Drawings I had made of them in their proper Situation, but from the Muſcles themſelves after Diſſection. And Care is taken, that all thoſe Muſcles that are done leſs than the Life, bear a Proportion to one another: And all thoſe that are expreſs'd as big as the Life have this Mark to them ✠.

THE Muſcles of the Internal Ear only are done bigger than the Life, to make them the more diſtinctly viſible.

SYLLABUS MUSCULORUM
EÂ SERIE
Qua in Ordinarijs Corporis Humani
Ἀνατομαῖς Diſſecantur

MUSCULI Abdominis

1 *Obliquus* *Deſcendens*
2 *Aſcendens*
3 *Pyramidalis*
4 *Rectus*
5 *Tranſverſalis*

TESTIUM

6 Cremaſter

Penis

7 Accelerator Urinæ
8 Erector *Penis*
9 Tranſverſalis *Penis*

Clitoridis

10 *Erector* Clitoridis
11 Sphincter *Vaginæ*

Veſicæ Urinæ

12 *Detruſor Urinæ*
13 *Sphincter Veſicæ*

ANI

14 Sphincter *Ani*
15 Levator

FRONTIS *et* Occipitis

16 *Occipitalis*
17 *Frontalis*

Genarum et. *Labiorum*

18 Quadratus *Genæ*
19 Buccinator
20 Zygomaticus
21 *Elevator* Labiorum
22 *Depreſsor*
23 *Orbicularis*
24 Elevator *Labij Superioris*
25 Depreſſor *Labij Inferioris*
26 Elevator

PALPEBRARUM.

27 *Orbicularis Palpebrarum*
28 *Aperiens Palpebram Rectus*

Oculi

29 Obliquus *Superior*
30 *Inferior*
31 *Elevator* Oculi
32 *Depreſsor*
33 *Adductor*
34 *Abductor*

NASI

35 Elevator *Alæ Naſi*
36 Dilatator *Alæ Naſi*
Elevator *et Labij Superioris*
37 Conſtrictor *Alæ Naſi*

AURICULÆ

38 Attollens Auriculam
39 Retrahens

Auris Internæ

40 *Externus* Auris
41 *Obliquus*
42 *Internus*
43 *Muſculus Stapedis*

Oſſis Hyoidis

44 Sternohyoideus
45 Coracohyoideus
46 Stylohyoideus
47 Mylohyoideus
48 Geniohyoideus

LINGUÆ

49 *Genioglosſus*
50 *Ceratoglosſus*
51 *Styloglosſus*
52 *Baſioglosſus*

Uvulæ

53 Gloſſoſtaphylinus
54 Sphenoſtaphylinus
55 Pterygoſtaphylinus

Faucium

56 *Stylopharyngæus*
57 *Oeſophagæus*
58 *Vaginalis Gulæ*

LARYNGIS

59 Sternothyroideus
60 Hyothyroideus
61 Cricothyroideus
62 *Cricoarytænoideus* Poſticus
63 Lateralis
64 Thyroarytænoideus
65 Arytænoideus

Maxillæ Inferioris

66 *Temporalis*
67 *Maſseter*
68 *Digaſtricus*
69 *Pterygoideus* Internus
70 Externus

Thoracis Interioris

71 Serratus *Minor* Anticus
72 *Major*
73 *Subclavius*
74 Scalenus *Primus*
75 *Secundus*
76 *Tertius*
77 Triangularis
78 Diaphragma
79 Intercoſtales *Interni*

by thoſe very few, who through the Courſe of all the learned Ages, at great Intervals of Time, have diſtinguiſhed themſelves by purſuing their Searches into Nature upon true Principles, had occaſioned Philoſophers wholly to deſpair of arriving at any Certainty in the more recluſe Parts of Phyſics. For now our great Philoſopher has at length in ſo ſurprizing a manner enter'd into the Depths of Nature, we find much leſs reaſon to admire, that his Diſcoveries had lain ſo long concealed, than that they ſhould ever have been ſearched out. Diſcoveries that have given a proof of the moſt flowing and abounding Invention, of the profoundeſt Penetration, and of the ſublimeſt Force of Reaſon: Not only where it was neceſſary to apply the ſubtleſt Parts of Geometry, and even to improve that Science much beyond its former Bounds; as where he has diſcloſed the Nature and Operations of Fluids, and diſcovered the great Principle, that keeps in motion the large Bodies of the Univerſe; but if poſſible, yet more in thoſe Advancements he has made from the conſideration of Light into a more hidden part of Nature, by the moſt refined and powerful Reaſonings upon the moſt obvious Obſervations, even to the deducing many wonderful Secrets of Nature from things, which appeared wholly barren not only to common Capacities, but to the Philoſophers of the greateſt Penetration.

EVEN fully to perceive the Progreſs this excellent Perſon has made in the real Knowledge of Nature, calls for the utmoſt Application and Thought; inſomuch that many, who would have formerly paſſed for no mean Philoſophers, have ingenuouſly owned themſelves unable to comprehend ſome of Sir *Iſaac Newton*'s moſt ſublime Speculations. But however difficult the ſearching into Nature may appear, doubtleſs when this true Metbod of Philoſophy comes to be generally underſtood, it will entirely put a ſtop to the falſe way, that has prevailed in the World. When we ſee thoſe Principles of natural Operations, that are now diſcovered, are ſo widely diſtant from our moſt refined Conjectures concerning them, it will be impoſſible for us for the future to receive any kind of Hypotheſis with the leaſt approbation. If in one of the moſt ſimple Productions of Nature, the Motions of the heavenly Bodies, the Principle by which they are preſerved, is ſo much above the reach of our Conceptions, that we hardly find any one, that can reconcile it to his Thoughts, who does not ſee the full Force of the Demonſtrations, by which it is proved; how can we conceive the briſkeſt Imagination ever able to diſcover any of the more concealed Springs of natural Effects? Theſe Conſiderations ſurely will intirely free us from that Miſtake the Philoſophers ſeem to have laboured under, who imagined it was required of them to account for almoſt all the Appearances of Nature; inſomuch that we find the very manner how a World or an Animal might be formed, is frequently attempted by the Framers of Hypotheſes, who yet were ſo far from being qualified for ſo daring an Enterprize, that on the contrary they have ſhewn themſelves not really able to diſcover the obvious Laws of Motion. But we ought to be more modeſt in our Inquiries, and not go ſo precipitantly to work. If we can truly diſcover any one ſtep, Nature takes in her Productions, we ought to look upon it as a conſiderable Attainment, without repining at our not being able to trace her

through

INTRODUCTION.

Concerning the

MUSCLES and their ACTION.

As all the Appearances of Nature furnish matter for Speculation worthy of a rational Mind; so those of the Animal Œconomy more particularly recommend themselves to our Consideration. For the knowledge of the Causes, from whence the various Operations and Changes wrought within our selves do arise, may be of more immediate use, as it may aid us in the discovery of proper means to guard against, or to remedy the many Disorders, the human Body is constantly subject to. But since the animal Machine is one of the most curious and delicate of all Nature's Productions, that come under our Observation; and consequently to determine the use of its Structure and Parts requiring the greatest Sagacity and Judgment; it is no wonder that the arriving at any tolerable degree of Knowledge in this Subject, has more effectually been prevented by the false Methods of enquiry, that have for many Ages prevailed among Philosophers. Even the gross occult Qualities of the Ancients have hardly given a greater obstruction to the Improvement of this most useful Branch of Science, than the more refined Species of such Qualities

lities introduced by the Moderns, under the denomination of Hypotheſes. The only remedy againſt this Inconvenience is the ſame here, as in the other Parts of Philoſophy; to lay aſide all myſterious and unintelligible forms of Speech, nor any longer to be employed in determining the Operations of Beings, to whoſe very Exiſtence we are altogether Strangers; but to enquire after ſuch real Cauſes, as the Phænomena neceſſarily imply, and to endeavour by a farther ſearch to diſcover the degree and manner of the Action of thoſe Cauſes; purſuing theſe ends by the proper Means of attaining them, which are only Experiments and juſt Reaſonings drawn from Mathematical Principles.

ALTHOUGH the immenſe Difficulty of this way of proceeding has hitherto prevented great Improvements in this Subject, yet ſome parts of the animal Body, and ſome few of its Operations, have been by theſe Methods ſucceſsfully ſearched into. From the time that the invention of the Teleſcope occaſioned the effects of Diaphanous Bodies upon Light carefully to be examined, very conſiderable advances have been made in the Diſcovery of the uſe of the ſeveral parts of the Eye, which aſſiſt in Viſion. And to come nearer to our preſent Purpoſe, Mechanicks applied to the Muſcles have largely inſtructed us in their Action. But indeed in theſe, as well as in every other part of the Body, we have a proof of the Deficiency of our Capacity to penetrate very far into the Secrets of Nature. For notwithſtanding we are able exactly to trace the Species of things manifeſted by Sight to their Impreſſion on the Optick Nerve, and have diſcovered by what Principles, and by what Mediums, the Images of external Objects are formed in the Eye; yet what effects thoſe Images have on the Nerve, whereby the Perception of the things themſelves is cauſed, remains wholly a Secret to us. In like manner in our preſent Subject, while we can reduce to rule, and determine the effects of the Muſcles upon the Parts they belong to, we continue altogether in doubt concerning the Cauſe, that puts them in action; both which laſt Reflections in relation to the Muſcles I deſign in this Diſcourſe particularly to illuſtrate.

BUT in the firſt place, it may not be improper to ſay ſomething of the Muſcles in general. Theſe taken at large are perhaps the moſt immediate Inſtruments of all the Motions, that are produced in the Body; for it is not improbable that every Coat, Membrane and Fibre thereof, exert their ſeveral Motions, by much the ſame Principle, as thoſe parts do, that have more generally been called Muſcles. Amongſt theſe laſt, ſome are the Inſtruments of voluntary, others of involuntary Motion, and others again of a Motion compounded of both theſe. But we ſhall here chiefly conſider the Inſtruments of voluntary Motion; for if they be not of themſelves the ſimpleſt, yet as their Operations are moſt obvious to us, ſo we are better acquainted with the manner and degree of their effects on the Parts, their Action is employed about, than with the like Properties of the other ſorts. The principal Muſcles then, that ſerve for voluntary Motion, are what chiefly give Subſtance

to

to the Body, and what cloath the Bones of the Trunk and Limbs, with what is called Fleſh. This Fleſh is not one continued Maſs, but is diſtinguiſh'd into divers Portions. Each Portion of Fleſh is called a Muſcle. Theſe Muſcles are diſpoſed of in ſuch a proper manner all over the Body, as to conduce to the elegance and beauty of its Structure, as well as to the execution of each particular Muſcle's office. Though theſe Muſcles lie in a manner contiguous to one another, yet each of them is ſeparated from the reſt, either wholly or in part, by a Membrane proper to it. This Membrane, though very thin, in robuſt and well fed Bodies is filled with Fat, and in hydropical Subjects charged with Serum.

As the office of theſe Muſcles is to change the Situation of ſome parts of the Body in reſpect to others, each Muſcle muſt be annexed to the different Parts, between which its Action is divided. And theſe are generally the Bones. And whereas upon the ordinary Action of any Muſcle, one of the Parts, to which it is annexed, remains more ſtable, with regard to the Trunk of the Body, than the other; the extremity of the Muſcle, annexed to the more ſtable part, is called either the Head or the Origine of the Muſcle, as the other Extremity, inſerted into the moſt moveable part, is called the Tail or Inſertion of the Muſcle, and the middle part lying betwixt theſe two, which ſwells, while the Muſcle acts, is called its Belly.

Each Muſcle is made up of two different Parts, diſtinguiſhed by their Colour, a fleſhy part, which appears red, and a tendinous, which is white. Theſe are continuous to one another. The fleſhy Parts are compoſed of divers ſlender Portions, which are likewiſe ſtill compoſed of very fine Fibres, that lie along each other. But of the Structure of the ſmaller Parts of the Muſcles we ſhall ſpeak more hereafter. Theſe fleſhy parts appear furniſhed with Blood Veſſels, Nerves and Lymphaducts.

The other ſort of Fibres, that conſtitute the Tendons of the Muſcles, are more compactly joined together than thoſe of the fleſhy Parts; inſomuch, that in a human Body there is no appearance to the naked Eye of the Interpoſition of Blood Veſſels, Nerves, or the like; though theſe may be here diſcovered by the aid of a Microſcope; and may be ſeen without Magnifying Glaſſes in the Tendons of larger Animals, in particular in the Tendon of the *Gaſterocnemius* Muſcle of a Horſe.

The Blood Veſſels belonging to the Muſcles are Arteries and Veins, with both of which each Muſcle is furniſhed. The firſt brings to the Muſcle Blood from the Heart, which Blood is returned thither again by the Veins. As by this circulating Fluid all parts of the Body are kept in repair, ſo to it the Muſcles owe the redneſs of their fleſhy Fibres, which appear white after frequent waſhings.

washings. To the Nerves, the Muscles, as well as the other parts of the Body, owe their Sense, and likewise their Motion.

These Blood Vessels, and Nerves, usually enter the Muscle nearer to the Head thereof than to the other Extremity, which has occasioned another Definition of the Head of the Muscle, than that before given, namely, that it is the part, at which the Blood Vessels and Nerves enter; but this is a very imperfect Characteristic to determine this Part of a Muscle, seeing many Muscles have Vessels entring into them in two or three different Parts; and moreover, the present Description joined with the other, that the Head or Origine of a Muscle is its least moveable Part, has given rise to very false reasoning in respect to the use of some Muscles. In particular it has been argued concerning some of the Muscles of the Larynx, that the inferior part of them is the least moveable, by reason that the Nerves enter them at that end; whereas this is no consequence at all: for the fixedness of any part of a Muscle cannot be caused by such tender and flexible Bodies as the Nerves and Blood Vessels, but by the stability of the solid Part, to which it is affixed.

Of the Lymphaducts, which we observed to belong to the Muscles, it will be sufficient just to take notice, that these fine and transparent Vessels receive from the Blood its more limpid Parts; which however proper to be carried off at the places, where these Lymphatics arise, is not a Fluid become wholly useless to the Animal; but is returned again into the Veins; and in its Passage thither mixing with the Chyle, seems to have a particular Use in rendring the alimentary Juice more fluxile, and facilitating its Assimilation with the Blood.

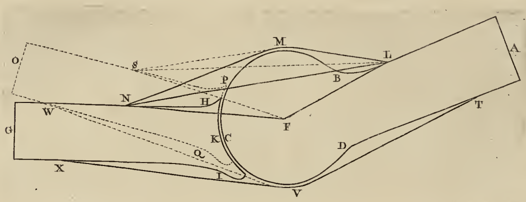
AND this may suffice in general concerning the Structure of the Muscles. But the manner and degree of their Action I design to consider more at large: In order to which, it must be observed, that the Muscles perform their Office by the contraction of their Fibres, that Contraction producing the Decurtation of the whole Muscle. From hence arise two Questions to be discussed, relating to the Action of the Muscles. The one enquires into the Cause of the Contraction of a muscular Fibre; the other, how this Decurtation of the Muscles is conducive to the Production of the several Motions thence arising. The first of these Questions relates chiefly to the use of the Nerves and Blood in the Contraction of the Muscles; and the second has reference to the Situation and Disposition of them in respect of the Parts, they move. These two Questions I shall here treat of separately in two distinct Parts; and as the latter Question falls most easily under Examination, it may conveniently be spoke to in the first place.

PART I.

Part I.

THE first caſe, I ſhall conſider, is that of a Muſcle appropriated to the Inflection or Extenſion of a Joint, being connected only to the Bones of that Joint, by each of its Extremities to one of them. Now the Joints are for the moſt part, in the Limbs eſpecially, a Conjunction of two Bones in the following manner. One of the Bones is terminated in a round Head, approaching either to a ſpherical or cylindrical Form; which is received by a Cavity, called by Anatomiſts a *Sinus*, formed in the other Bone of a correſpondent Figure, and ſo received as to be moveable in it; and the Motion will be performed upon the Center of the ſpherical Head, or upon the Axis of the cylindrical one. When the Heads of the Bones deviate from a regularly ſpherical or cylindrical Figure, which they are found to do remarkably in ſome Joints, the Center or Axis of Motion is continually changing, being different in different Flexures of the Joint. But then the Center, or Axis of the Motion may be determined, in any propoſed Situation, by finding a Sphere or Cylinder of the ſame Curvity with the Head of the Bone in that Part, wherein it is in contact with the *Sinus*; which, in this caſe, it will not be in all its Parts, as when the Head is of a more regular Figure. The ſuperior Head of the Thigh Bone, by which it is joined with the *Os Innominatum*, is the moſt perfect Example in the Body, of a regularly ſpherical Figure; and the inferior Head of the *Humerus*, that part of it, which is articulated with the *Ulna* in the Joint of the Elbow, with no leſs Exactneſs cylindrical; excepting the circular Indentures made in it, for the more firm Connection of the Joint, which do not anywiſe influence the Axis of the Motion, they being concentrical to it. Now a Muſcle connected by each of its Extremities to one of the Bones, which conſtitute a Joint, muſt be more extended in ſome Angles, which the Bones ſhall make with each other, than will be required in other Angles; except only when the Muſcle is connected to the very Axis of the cylindrical Joint. Hence, when the Muſcle exerts its contracting Power, if the Direction in which the Muſcle will contract, be not in a right Line paſſing through the Center or Axis of Motion, it will endeavour to reduce the Joint into that Diſpoſition, wherein the leſſer length of the Muſcle is required.

Let *ABCDA* be a Bone, having a round head *BCD*; the Center of this Head *F*, if the Head be ſpherical; if cylindrical, let the Axis of it paſs through *F*, and be perpendicular to the Plane of this Scheme. Let *GHKIG* be a Bone, having a hollow *Sinus HKI* adapted to the Head *BCD*; ſo as to form a Joint. Let *LMN* be a Muſcle not paſſing through the point *F*, nor yet the Axis drawn through *F* perpendicular to the Plane of this Scheme. Let the Joint be bent, till the Bone



GK be removed into the Situation *OPQO*, and the Muſcle obtain the Situation *LMS*: Then, I ſay, the Muſcle in the Situation *LMS* is ſhorter than in the Situation *LMN*. Draw *FL*, *FN*, *FS*, *LN*, *LS*: then in the two Triangles *LFN*, *LFS* the Side *LF* is common to both, and the Sides *FN*, *FS* equal, but the Angle under *LFN* greater than that under *LFS*; wherefore the Baſe *LN* is greater than the Baſe *LS*: And beſides, the Angle under *FLN* is leſs than that under *FLS*; ſo that the point *M* is farther diſtant from the Line *LN* than from *LS*. Therefore if the Figure *LMS* were ſo applied to the Figure *LMN*, that the point *L* remained common to both, and the Line *LS* fell upon *LN*, the Line *LMS* would fall wholly within the Line *LMN*, though the point *S* were to fall upon the point *N*; but the Lines *LMS* and *LMN* would likewiſe be concave towards the ſame Part, therefore the Line *LMS* would be ſhorter than *LMN*, though the point *S* were to fall upon *N*, and the Line *LS* were equal to *LN*, but *LS* is leſs than *LN*; whence the Line *LMS* will be ſtill ſhorter than *LMN*.

Upon the ſame Principles the Muſcle *TVW*, on the other ſide of the Joint, connected to the Bone *AC* in *T*, and to the Bone *OPQO* in *W*, will be ſhortened, when the Bone *OPQO* is reſtored to the Situation *GK*, and the Muſcle have the Situation *TVX*.

From all this it is evident, by the Principles of Mechanics, that when the Muſcle *LMN* contracts it ſelf, if it lie not directly over the Axis of the Joint's Motion, it will inflect the Joint, drawing the Bone *GK* towards the Situation *OPQO*; and the Contraction of the Muſcle *TVW* will extend the Joint, by reducing the Bone into its original Situation. By its farther Contraction the Joint will be bent the contrary way, except the form of the Joint, and the Ligaments, by which the Bones are connected, prevent it.

It

It is here to be obſerved, that the Muſcles are uſually connected to one of the Bones very near the Joint, by which means the Flexors of the Joints are preſerved contiguous to the Bones in all their Motions. When both the Extremities of a Muſcle are far diſtant from the Joint, the Muſcle is bound down to the Joint by a Ligament. In this caſe the Method of ſhewing, how the Inflection of the Joint ſhortens the Muſcle, muſt be ſomething different from the foregoing: But the principal Alteration required is, that inſtead of the Line *FL*, which is common to the two Triangles *LFN*, *LFS*, the Line muſt be taken, which will join the point *F*, and the place of the Muſcle inveſted by the Ligament; becauſe the diſtance of the Ligament from that Extremity of the Muſcle, connected to the Bone, from which the Ligament takes its riſe, remains always near the ſame.

BUT now this confining of the Muſcles down to the Bones anſwers two very valuable Purpoſes; one is, that the ſmall degree of Contraction, it was proper to allow the Muſcles, may give to the Joints a ſufficient Motion; the other, that the Figure of the Limbs may be preſerved. But then this conſequence on the other hand follows from hence, that the Reſiſtance, which is applied to the Extremity of the moveable Bone of any Joint, and is ſupported by the Muſcles of that Joint, bears but a ſmall proportion to the force required in the ſuſtaining Muſcles. In the preſent Figure, ſuppoſing the Bone *AC* to be fixed, the other *GK* will perform the Office of the mechanical Power, called the Lever; of which *F* is the Fulciment, by which it is ſuſtained, *N* the point to which the moving Power is fixed, acting obliquely in the direction of the right Line *NM*. If a Reſiſtance be applied to the Extremity of the Bone *G*, then by the Principles of Mechanics the force of the Muſcle, acting in the direction *MN*, will be to the Reſiſtance in *G*, when the force of the Muſcle and Reſiſtance are in *Æquilibrio*, as the Perpendicular let fall from the point *F* upon the Line, in whoſe direction the Reſiſtance in *G* is applied, to the Perpendicular let fall from the ſame point *F* upon the Line *MN*. For inſtance, if the Bone *GK* be held parallel to the Horizon, and a Weight be ſuſpended, by the action of the Muſcle *LMN*, at the Extremity of the Bone *G*; becauſe in this caſe the Direction, in which the Weight reſiſts, is perpendicular to the Bone, the force required in the Muſcle *LMN* to ſuſpend the Weight applied in *G* will be to that Weight, as the whole diſtance of the point *G* from the point *F*, to the perpendicular let fall from *F* upon the Line *MN*.

In the ſame manner may be found the Power required in the Muſcle to ſupport the Weight of the Limb in any Situation; for that Power of the Muſcle will be to the Weight of the Limb, as the Perpendicular let fall from the Center of the Joint upon the Line drawn perpendicular to the Horizon, through the Center of Gravity of the Limb to the Perpendicular let fall from the Center of the Joint upon the part of the Muſcle, that lies in the direction of its Action.

BORELLI

BORELLI in his Treatiſe concerning the Motion of Animals * contends that the force of the Muſcle is double to that which is aſſigned by this Rule. He collects this from the following Aſſertion, which he takes great pains to demonſtrate; That if a String be connected to a Peg, and diſtended by a Weight hung at it, the Reſiſtance of the String ſhall be equivalent to double the Weight; or if a Stick be erected perpendicularly upon the Ground, or upon one's Hand, and compreſſed by a Weight placed upon the upper end of it; the Reſiſtance of the Stick ſhall be equivalent to double the Weight ſupported. Though *Borelli* is very large upon this, and has drawn out his Proof into ſeveral Propoſitions; yet all he has advanced ſeems to me little more than a playing upon Words. The whole of what he ſays amounts to this, That the Reaction of the Peg, to which the String is fixed, and of the Hand or Ground, which ſupports the Stick, is equal to the Weight, by which the String is diſtended, and the Stick compreſſed; and the String and Stick are affected by both. But may one not with as much Reaſon ſay, that the String is diſtended, and the Stick compreſſed by the Weight only, becauſe the Weight being removed, the Diſtenſion and Compreſſion entirely ceaſe. It is true likewiſe, if the Peg or Ground be removed, the String will not ſuffer Tenſion, nor the Stick be compreſſed by the Weight connected to them: It may therefore be aſked, whether the Tenſion of the String and Compreſſion of the Stick may not be aſcribed to them. And certainly they may; though this being to refer the Effect of an active Power to the Reſiſtance, which ſupports its Action, the uſual manner of ſpeaking favours the other way of expreſſing it. But if the Stick be ſupported by the Hand, the Powers applied to both its Extremities are equally active, and the Compreſſion of the Stick may be attributed to either. Yet it is altogether as proper, I think, to ſay that this Compreſſion is equivalent to one of them only, becauſe if one be removed, the Action of both upon the Stick will ceaſe, and if, in the room of the active Power of the Hand, the Ground which is paſſive, be ſubſtituted, the Compreſſion of the Stick will remain the ſame; as to ſay, with *Borelli*, that becauſe whether the Ground or Hand ſupport the Stick, the Compreſſion will not be different, and when the Hand is uſed, there are applied to the Stick two active equal Forces; therefore when the Ground ſupports it, its Compreſſion is equivalent to twice the ſingle active force applied to it. The ſame may be ſaid of the other Method he takes to confirm his Opinion, drawn from the Conſideration of a String inflected over a Pulley with an equal Weight hung at each end, the Tenſion of which will remain the ſame, if one of the Weights were removed, and the end of the String, to which it was faſtened, tied to a Peg. Whence he concludes, that when there is but one Weight, and the other end is faſtened to a Peg, the Reſiſtance of the String may be ſaid to be equivalent to twice that ſingle Weight, becauſe the String is ſtretched as much by that, as it is, when the other Weight equal to the firſt is hung to the end before tied to the Peg. But may it not as well be ſaid, that the Reſiſtance or Tenſion of the String is

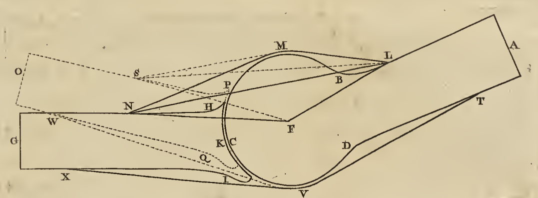
* De Motu Animal. Par. I. c. 10.

equivalent

equivalent to one of the Weights only, when two are tied to the String, becauſe the preſence of the other Weight is neceſſary in order for the action of one of them; and if one be removed, and its place be ſupplied by a Peg, the Tenſion of the String will be no greater in the former Caſe than in the latter? Certainly theſe two different ways of Expreſſion amount only to this, that according to *Borelli* you affirm the String to be diſtended as much by one Weight as by both; in the other way you affirm the String to be no more diſtended by both the Weights than by one.

BUT now if this be ſo, that *Borelli* does only diſpute for an uncommon manner of Expreſſion, while the ſame thing is ſignified, as by the uſual way of ſpeaking, I ſhould chuſe to keep to that; ſince that can hardly draw us into any Error, which the other may, if we are not very carefully attentive to the Idea ſignified by it; for it has actually miſled *Borelli* himſelf, as will hereafter appear.

THUS much of computing the Force, with which the Muſcles act, that lie over one Joint. It next follows to ſhew how to determine the Direction of their Action; which is eaſily deducible from what has been ſaid. For in the Figure it is evident that the Direction, in which the Muſcle *LMN* acts, will be always according to the Line *MN*, which denotes the part of the Muſcle lying over the Joint, and



out of contact with the Bones; whatever the Poſition be of the part *LM*, included between the point *M*, where the Muſcle leaves the Bone *AC* in order to paſs over the Joint, and the Point *L*, its Connection with the ſame Bone.

SEVERAL Muſcles lie very oblique to the Direction, in which they act; tho' none, perhaps, more than the Muſcles of the Foot. From which an Inſtance or two taken will ſufficiently illuſtrate the Rule here laid down. To mention in the firſt place the *Peroneus primus* or *longus*, in which neither its Body, nor all that part of its Tendon from the *Os Cuboides*, under which it is inflected to its Inſertion into the innermoſt Bone of the *Metatarſus* ſupporting the great Toe, is direct to its Action. The Tendon eſpecially lies very remarkably oblique; the action of this Muſcle being not very different from that of the *Peroneus ſecundus*.

c I am

I am therefore ſurprized that *Riolan* * ſhould aſcribe to the firſt of theſe Muſcles, which he calls *Peroneus poſticus*, the Office of extending the Foot; and to the other, the *Peroneus ſecundus*, called by him *Anticus*, the contrary Office of bending it: For their Tendons lie contiguous upon the hinder and inferior part of the *Fibula*, and remain ſo during their Inflection under the outer Ancle, till the Tendon of the *Peroneus ſecundus*, which is the exterior one, is inſerted into the external part of the Root of the outermoſt Bone of the *Metatarſus*; and the other Tendon, at the ſame time inflected under the *Os Cuboides*, in a *Sinus* of which it is included by a Ligament, as it paſſes to its Inſertion. And by the Rule juſt now laid down, that part only of the Tendon of the *Peroneus ſecundus* between the outer Ancle, and its Inſertion, lies in the direction of its Action; and that part only of the Tendon of the *Peroneus primus* from the outer Ancle to its Inflection under the *Os Cuboides* lies in the Direction, in which that Muſcle acts. Which evidently ſhews both theſe Muſcles to give the Foot almoſt the ſame oblique Motion; the principal difference is, that the *Peroneus primus* does ſomething more extend the Foot; the Root of the outermoſt Bone of the *Metatarſus* by the one, and the *Os Cuboides*, which ſupports the internal part of the Root of that outermoſt Bone of the *Metatarſus*, by the Action of the other will be moved nearly in the ſame Direction, that is to ſay, upwards and backward. They both conſpire with the Extenders of the Foot in raiſing the Body, in walking, upon the Ball of the great Toe. It appears therefore from what has been ſaid, that the Action of the *Peroneus primus*, of which we undertook principally to ſpeak, is the ſame, as if its Tendon were connected to the *Os Cuboides*. Though the carrying this Tendon acroſs the Foot, and inſerting it into the Bone of the *Metatarſus*, which ſupports the great Toe, anſwers a very conſiderable End: For the Junctures of the Bones of the *Tarſus* are more effectually ſtrengthened and ſecured by this Contrivance, than if a Ligament of equal Strength had connected the *Os Cuboides* and innermoſt Bone of the *Metatarſus* together.

THE *Tibialis poſticus* affords another Inſtance of a Muſcle, whoſe greateſt part lies oblique to its Action; that being in the Direction of the Part of its Tendon, between the Inflection of it under the inner Ancle, and its Inſertion; to which the whole Body of the Muſcle lies very oblique. The uſe of this Muſcle is to enable the Extenders of the Foot, by acting in conjunction with them, to raiſe the Body upon the Balls of the leſſer Toes; an Action which in walking we are obliged to perform, as often as the inner part of the Foot has received any hurt.

THUS far in the general of the Action of Muſcles paſſing over one Joint. Before I proceed, I think it not amiſs, upon the making mention of theſe Muſcles of the Foot, to obſerve how admirably the Flexors of the Foot are contrived to

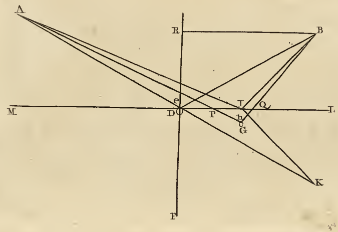
* Anthropograph. Lib. V. cap. 43.

be

be proper Antagonists to them. These Flexors are two, the *Tibialis anticus*, and that parcel of Fibres, which *Vesalius* * and Mr. *Cowper* observe to arise from the *Extensor Digitorum Pedis longus*, and to send a Tendon to the outside of the Foot. The Action of the *Peronei* with the Extenders of the Foot being the most common, the Tendon of the *Tibialis anticus* is not inserted into the middle of the Foot, but chiefly into the innermost Bone of the *Metatarsus*, by which means it is rendered directly the Antagonist to that Action; and yet by the assistance of the other parcel of Fibres, may become, when Occasion requires, the Antagonist to the other Motion of the Foot, when the Extenders and *Tibialis posticus* act together.

I SHALL further add to what has been said in the general, before I proceed to the Muscles lying over two or more Joints, which are next to be spoke to, a distinct Explication of one Case, which does not readily come under the general Rule. This is the Case of the *Digastric* Muscle of the lower Jaw; which lies over one Joint only, *viz.* that of the lower Jaw Bone with the Skull: but in a manner something particular. It is of that kind of Muscles, which are inflected in their Passage from their Origine to their Insertion; but not by the Bones forming the Joint, as those before treated of; but by its passing through an annular Ligament of the *Os Hyoides*, and retained in its inflected Situation by the Muscles of that Bone. Whence in this Muscle, not only its own Force, and Direction, in which it acts, are to be explained; but likewise the Force required in the Muscles of the *Os Hyoides* to support its Action.

LET *AeB* be the *Digastric* Muscle, inflected at *e* through the Ring *D*, connected to the *Processus Styloides* in *A*, and to the Jaw Bone in *B*. Now the Muscle *AB* having a free Passage through the Ring *D*, it will always contract so much,



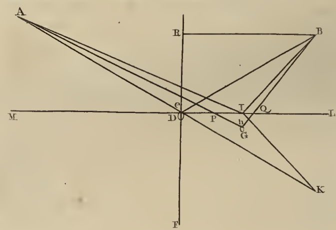
as to render it self the shortest, that can be for any given Tension of the Muscles supporting the Ring *D*, and given Position of the Extremity *B* of the Jaw Bone. Which being considered, I say the right Line, in whose Direction the Ring *D* acts upon the Muscle *AB*, always divides the Angle under *AeB* into two equal Parts:

* De Corp. human. fabric. Lib. II. cap. 59. Musculus pedem moventium nonus.

For

For when the Angle under AeB is ſo divided, the Line AeB will be the ſhorteſt; as is thus demonſtrated.

Let eF be the Line, in whoſe Direction the Muſcles of the *Os Hyoides* ſupport the Ring D. Draw MeL perpendicular to eF, and produce Ae to K, till eK be equal to eB. Then becauſe the Angles under AeF, FeB are equal, and MeL is perpendicular to eF, that is the Angles under MeF, FeL are equal, the Angles under MeA, LeB are likewiſe equal: But the Angle under LeK is equal to the Angle under MeA; therefore the Angles under KeL, BeL are equal. Now let the Ring D change its Poſition to that of G: Then becauſe the Line ML is perpendicular to the Line, in whoſe Direction the Ring in the Poſition D is ſupported, and the Muſcles which ſupport it, are ſuppoſed to have no additional degree of Tenſion given them by the changing of the Poſition of the Ring, the Ring muſt fall without the Line ML, and the Muſcle inflected through it obtain the Situation AhB, cutting the Line ML in two points P, Q. Take at pleaſure in the Line ML between P and Q the point I, and join AI, IB, and IK. Then in the two Triangles BeI, KeI the ſide eI is common to both, and the ſides eB, eK, as likewiſe



the Angles under BeI, KeI equal: therefore the Baſes IB, IK are equal. Whence the two Lines AI, IB are equal to the two Lines AI, IK, which exceed the Line AK; becauſe in every Triangle two of the ſides are always greater than the third; but the point I is within the Angle under AhB, ſo that the Sum of the Lines AI, IB is leſs than the Sum of the Lines Ah, hB: Therefore the two Lines Ah, hB are greater than the Line AK, equal to the two Lines Ae, eB. Hence the Muſcle AeB is ſhorter in the Poſition D of the Ring than in any other.

But now from hence will be eaſily determined all that is to be enquired into relating to this Muſcle. The Ring D being at reſt, when the Angle under AeB is divided into two equal Parts by the Line eF, the Action of the Muſcle AeB will be the ſame, whether it be connected to the Ring D in the point e, or diſengaged from it, as has hitherto been ſuppoſed. For the Angles under AeF, FeB being equal, the Tenſions of the two parts Ae, eB of the Muſcle would be equal, if it were connected to the Ring D in e, as well as when diſengaged from it; and

will

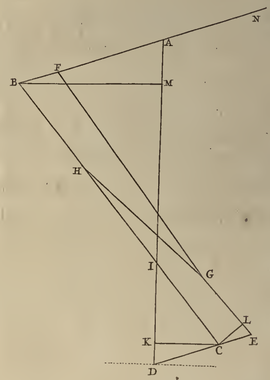
will likewiſe be juſt as great in one caſe, as in the other. Therefore if from the point *B* the perpendicular *BR* be let fall upon the Line *Fe*, the force of the Part *eB* of the Muſcle, or, which is the ſame thing, the force of the whole Muſcle, will be to half the force, with which the Ring *D* is ſupported in the Direction *Fe*, as *Be* to *eR*. For this the Writers of Mechanics have demonſtrated in the Caſe of the Muſcle's being connected to the Ring *D* in *e*. So that the force of the Muſcle *AeB* is to the whole force, with which the Ring *D* is ſupported, as *Be* to twice *eR*.

AGAIN, the two Parts of the Muſcle *Ae*, *eB*, and the Ring *D*, are three Powers applied to the point *e* of the Muſcle, acting in the reſpective Directions of *eA*, *eB*, and *eF*. But the Part *eB* is ſuſtained by the point *B*, the moveable Extremity of the Jaw; upon which therefore it will act in the Direction oppoſite to that, in which it acts upon the point *e*. That is, the part of the *Digaſtric* Muſcle between its Connection with the Jaw, and the annular Ligament of the *Os Hyoides*, through which it paſſes, lies in the Direction of its Action upon the Jaw.

THE Rule juſt laid down for aſſigning the Proportion of the force, with which the annular Ligament of the *Os Hyoides* is ſupported, to that of the *Digaſtric* Muſcle, ſhews how a ſmall degree of Force applied to this Ligament, may retain the Muſcle in an inflected Situation: for the Angle under *AeB* may be taken of ſuch a Magnitude, that twice *eR* ſhall be to *eB* in any *ratio* leſs than that of 2 to 1. And the Force, with which this Ligament is ſuſtained againſt the Action of the *Digaſtric* Muſcle, is in reality conſiderably leſs than the Force of the *Digaſtric* Muſcle it ſelf; the *Muſculus Coracohyoideus* with a ſmall Aſſiſtance from the *Stylohyoideus* being the principal, or rather the ſole Supporter of that Ligament.

NOW it follows to treat of thoſe Muſcles, which lie over two or more Joints. The Influence theſe Muſcles have upon one of the Joints, over which they paſs, is eaſily determined; for they will contribute to the Motion of any one of the Joints, if the reſt be fixed and held inflexible by other Muſcles, in the ſame manner, as if they lay over none but that: and the Method of judging of their Direction, and eſtimating their Force is entirely the ſame: for the fixing the reſt of the Joints determines the Action of the Muſcle to that Joint, which is left moveable, as much as if thoſe fixed Joints were one continued Bone. But the effect of ſuch a Muſcle upon thoſe other Muſcles, which ſecure the reſt of the Joints, is ſomething leſs obvious, and muſt diſtinctly be conſidered. For which purpoſe two Caſes are ſeparately to be examined; both attempted by *Borelli*, but neither ſufficiently explained by him. One is, when a Muſcle lies over two Joints, which bend the contrary way; the other when the Joints, over which the Muſcle lies, bend the ſame way.

The Joints of the Knee and Foot, covered by the *Gaſterocnemius externus*, are an inſtance of the firſt Caſe. For explaining this Caſe therefore, let *AB* repreſent the Thigh Bone, *B* the Knee, *BC* the *Tibia*, *C* the Joint of the Foot, *ED* the Foot it ſelf, *GF* the *Muſculus Gaſterocnemius externus* connected to the Thigh Bone



in *F*, *GH* the *Gaſterocnemius internus*, called by ſome the *Soleus*, connected to the *Tibia* in *H*, their common Tendon *GE* affixed to the *Os Calcis* in *E*. Let the Extremity of the Foot reſt upon the Ground in *D*; and a Power be applied to the point *A* of the Thigh Bone *AB*, in the Direction of *AD*; let the Joint of the Knee *ABC* be held firm by its proper Muſcles: then if a Stick or other rigid Body were laid in the Line *AD*, that one of its Extremities ſhould touch, and reſt upon the *Tibia BC* in *I*, and the other Extremity touch the Thigh Bone in *A*, ſuſtaining the Power applied in that point *A*, the point *I* of the *Tibia BC* would be acted upon with the ſame Force, and in the ſame Direction as now, when the Power in *A* is ſuſtained by the Angle under *ABI*: for by the fixing and rendring unalterable the Angle under *ABI* the Magnitude and Poſition of the Line *AI*, in whoſe Direction the Power in *A* acts, is as much ſecured, as by a rigid Body directly interpoſed between *A* and *I*: the point *I* therefore is preſſed with the ſame Force, and in the ſame Direction in both Caſes. But by the Intervention of a rigid Body between *A* and *I*, the Power in *A* preſſes the point *I* with the ſame Force, and in the ſame Direction of the Line *AID*, as if the Power in *A* were applied to the point *I* in the Direction of *ID*. Therefore by fixing, and ſecuring the Angle under *ABI* from alteration, the point *I* is preſſed with the ſame Force, and in the ſame Direction by the Power in *A*, as if that Power were applied to the point *I* in the Direction of *ID*. Now the *Muſculi Gaſterocnemii*, *externus* and *internus*, act in ſupporting the Angle under *BCD* in the Direction of their common Tendon *EG*; and the Force, with which they muſt act to ſuſtain the Joint *C*, is to the Power applied in *A*, or *I*, by the Rule before laid down for Muſcles lying over one Joint, as *CK* the perpendicular let fall from *C* to the Line *ID*, in whoſe Direction the Power acting

acting againſt the Muſcles is applied, to CL the perpendicular let fall from the ſame point C upon EG, the part of the Muſcles ſupporting the Joint C, which lies in the Direction of their Action.

But this Force thus found muſt be divided between the *Gaſterocnemius internus* and *externus*. That part of it, which appertains to the *Gaſterocnemius internus*, has no Influence upon the Joint B, becauſe the *Gaſterocnemius internus* is connected to the *Tibia*. But the *Gaſterocnemius externus* being connected to the Thigh Bone in F, its Action, which is no other than drawing the points E, F towards each other, tends as well to diminiſh the Angle under FBC, as to augment the Angle under BCD. Whence though the Power applied in A were actually applied in I, yet there would be required ſome degree of Force to ſuſtain the Angle under FBC againſt the Action of the *Gaſterocnemius externus*. But the Power, againſt which theſe Muſcles act, not being applied in I, but in A, the Muſcles, whoſe Office it is to ſupport the Joint B, which are the Extenders of the *Tibia*, are required to exert a certain degree of Force to ſuſtain the Angle under ABC, and preſerve it from Diminution by the Preſſure of the Power in A. And to the Force, which they exert upon this account, muſt be ſuperadded that Force, which is required in them, to ſuſtain the Heads of the *Gaſterocnemius externus*.

And this is what is to be ſhewn in this firſt Caſe, that when a Muſcle, deſigned for the Motion of any Joint, paſſes over another Joint, and is inſerted into the ſecond Bone from the Joint whoſe Motion it is deſigned for; when the Joints bend contrary ways, it is a ſtrain upon the Muſcles of that other Joint, over which it paſſes, and requires a greater degree of Force in thoſe Muſcles, when a Power is ſupported by the united Action of the Muſcles of both Joints, than otherwiſe would be needful.

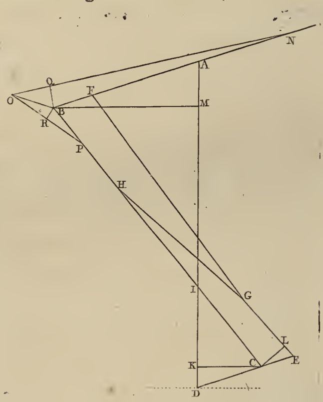
Further, the Force exerted by a Muſcle, paſſing over two ſuch Joints, in ſuſtaining the Joint, to which it properly belongs, being given, the degree of Force required in the Muſcles of the other Joint to ſupport its Action is eaſily determined. For inſtance, the Force required in the Extenders of the *Tibia* to ſupport the *Muſculus Gaſterocnemius externus* is to the Force, with which the *Gaſterocnemius externus* contracts, as the perpendicular let fall from B upon the Line FG, in whoſe Direction the *Gaſterocnemius externus* acts, to the perpendicular let fall from B upon that part of the Extenders of the *Tibia*, which lies in the Direction of their Action, that is the part of their Tendons which lies over the Joint. Otherwiſe, if from the Weight in A be deducted that part of it, which is ſuſtained by the *Gaſterocnemius internus*, the Ratio of the remaining Part to the Force required in the Muſcles of the *Tibia* to ſuſtain the Action of the *Gaſterocnemius externus*, will be compounded of the Ratio of CL to CK, and of the Ratio of the Perpendicular

let

let fall from B upon the Line FG to the Perpendicular let fall from the ſame Point B upon the Extenders of the *Tibia.*

Besides, as this laſt named Perpendicular to BM, the pependicular let fall from B upon the Line AI, in whoſe Direction the Power in A is applied, ſo is this Power applied in A to the Force required in the Extenders of the *Tibia* to ſuſtain the Angle under ABC againſt the action of this Power. And theſe two Proportions give the whole Force required in the Extenders of the *Tibia* for the Support of the Limb $ABCD$ againſt the Power in A.

THIS Method of computing the Force required in the Muſcles, which ſuſtain the Angle ABC is agreeable to the Rule laid down above. *Borelli* * attempts the ſame after a manner ſomething different. He compares theſe Muſcles to a String connected by one end to the Thigh Bone, and by the other to the *Tibia*; and



inflected over the Extremity of a Line drawn from the Joint: like as the Line NOP is connected to AB in N, to BC in P, and inflected over the Extremity O of the Line BO, drawn from the Point B. He does not expreſſly ſay whether he takes the Line BO to make a given Angle with one of the Lines AB, BC, or to be moveable at liberty about the point B. If he deſigned the latter Caſe, he treats of it very defectively, and is farther blameable for propoſing a Caſe, which does not correſpond to the Joints; if he deſigned the firſt Caſe, the Rule he gives is erroneous. His Rule is, that BQ being let fall from B perpendicular upon the Part NO of the String NOP, and BR drawn perpendicular to the Part PO, the Tenſion of the String NOP is to the Power applied in A as MB the perpendicular let fall from B upon the Line AD, in whoſe Direction the Power in A is applied, to the fourth Part of the Sum of BQ and BR †. He ſays the

* De mot. Animal. Part. I. Prop. XLIX, & LIII. pag. 91, & 97.

† De motu Animal. Part. I. Prop. XXXVIII. pag. 69. & Prop. XLIX. pag. 91.

fourth

fourth Part, upon the account of his aſcribing to Strings a Tenſion double to the Power, by which they are directly diſtended; which Opinion, or manner of Expreſſion, I have before objected againſt *: Otherwiſe he would have taken half the Sum of the Perpendiculars *BQ*, *BR*. Now in caſe *BO* be moveable upon the Center *B*, and its Angle neither with the Line *AB* nor *BC* determined, this Rule is free from Error, but defective, becauſe it does not obſerve the Perpendiculars *BQ*, *BR* to be equal, which they muſt be in order to the Suſtenſion of the Angle under *ABC:* for every part of the String *NOP* is equally diſtended, and the Tenſion of the Parts *NO*, *OP* being equal, they preſs upon the Point *O*, againſt which the String is diſtended in the Direction of the Line, which divides the Angle under *NOP* into two equal Parts; and that this Preſſure may be in the Direction of the Line *BO*, which is required in order to the Stability of the Line *BO*, and that it be held fixed by this Preſſure, the Line *BO* muſt divide the Angle under *NOP* into two equal Parts; that is, the Angles under *NOB*, *POB* muſt be equal. But in the Triangles *BOQ*, *BOR*, the Angles under *BOQ*, *BOR* being equal, as likewiſe the Angles under *BQO*, *BRO*, becauſe both are right, and the Side *BO* being common to both Triangles, the Baſes *BQ*, *BR* are equal; but the Diſtenſion of the String is to the Power applied in *A*, as *MB* to either *BQ*, or *BR*, and therefore to half the Sum of them. Conſequently the Rule laid down by *Borelli* in this Caſe is not erroneous: Though, as I obſerved before, the Caſe it ſelf is not applicable to the Joints, in which we find nothing ſupporting the Tendons, in ſuch manner as to preſerve conſtantly the ſame Diſtance from the Center or Axis of the Motion, at leaſt on the convex Side of the Joint. And even on the concave Side, the Ligaments, by which the Tendons are often tied in the Flexures of the Joints, are not uſually connected with the Bones near enough to the Axis of the Motion to perform ſuch an Office.

In the other Caſe, when the Line *BO* is ſuppoſed to retain always the ſame Angle, either with the Line *AB*, or *BC*, ſuppoſe with *BC*, then the Perpendiculars *BQ*, *BR* may be unequal; in which Circumſtance *Borelli's* Rule will be erroneous: for the Perpendicular *BR* let fall upon the Part *PO* of the String *NOP*, which ſubtends the given Angle, has no relation to the Tenſion of the String, that being performed in the Direction of *NO*, and therefore will be to the Power in *A* as *MB* the Perpendicular let fall from *B* upon the Line *AD*, in whoſe Direction the Power in *A* is applied, to *BQ* the Perpendicular let fall from the ſame Point *B* upon the Line *NO*, in whoſe Direction the String *NOP* is diſtended.

I differ from *Borelli* likewiſe in computing the Force, with which the Muſcles *GF*, *GH*, which ſupport the Angle under *BCD*, are diſtended. I have declared it to be the ſame, as if a Power were applied to the Point *I* in the Direction of the Line *ID*, equal to the Power applied in *A*. *Borelli* affirms it to be the ſame, as if a Power were applied in the ſame manner, which ſhould be to the Power applied in *A* as *MB* to *CK*. This he collects from the following Propoſition, which

* Pag. 8, 9.

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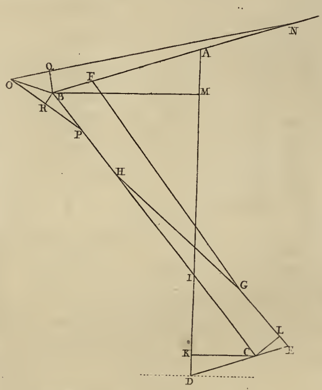
he attempts to demonſtrate, That a trilineal arched Figure as *MBCK*, compoſing two alternate Angles under *MBC*, *BCK*, and having two of its Sides *MB*, *CK* parallel, being given, if its extream Points *M* and *K* are impelled by two contrary Forces acting in the Direction of the ſame Line, *viz.* the Line *MK*, theſe Powers will be reciprocally proportional to the extreme Lines of the Arch, to which they are applied; that is to ſay, the Power applied in *M* will be to that applied in *K* as *CK* to *BM* *. Thus *Borelli* expreſſes himſelf. But this is a very indefinite manner of ſpeaking, and carries no determinate Meaning with it. Certainly Powers may be applied to the Points *M* and *K* in the Proportion aſſigned;



and in any other Proportion likewiſe. He ought to have expreſſed what Conſequence he expected from the Application of Powers in this Proportion. What is ſhewn, though very obſcurely, in that which he ſubjoins as a Demonſtration to the Propoſition, ſeems to me to be this: That if the Point *I*, in which the middle Line *BC* interſects the Line *MK*, in whoſe Direction the Powers act, be fixed by a third Power, and the Angles under *MBI*, and *KCI* be equally ſtrained by the Powers applied in *M* and *K*, then thoſe Powers will be in the aſſigned Proportion. And the Propoſition, which immediately ſucceeds this we are ſpeaking of, and depends entirely upon it, is expreſſed in the ſame confuſed Manner, but ſhews only this, That if inſtead of the trilineal arched Figure *MBCK*, in which the extreme Sides *MB*, *CK* are parallel, be taken the trilineal Arch *ABCD* in which the extreme Sides *AB*, *CD* may not be parallel, and in *A* and *D* be applied two ſuch contrary Powers, acting in the Direction of the ſame Line *AD*, as the Point *I* being fixed by a third Power, ſhall equally ſtrain the Joints *B* and *C*; then the Power applied in *A* will be to that in *D* in the aforeſaid Proportion of *CK* to *MB* †. But this is a Caſe widely different from that under Conſideration at preſent, to which *Borelli* compares it. For in that neither is the Point *I* fixed

* De motu Animal. Part. I. Prop. XLVI. pag. 86.

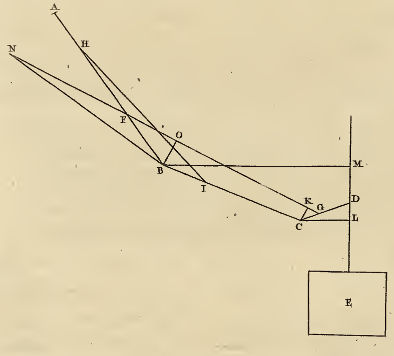
† De motu Animal. Part. I. Prop. XLVII. pag. 87.

by

by any third Power, nor the Angles under *ABC*, *BCD* neceſſarily ſtrained in an equal Degree. In neither of the Propoſitions of *Borelli*, I have mentioned, is any thing ſaid of a third Power applied in *I*, but muſt of neceſſity be ſupplied; for when the contrary Powers applied to the extremities of the Arch are not equal, the Machine cannot be ſupported without the Aſſiſtance of ſuch a third Power.

BUT theſe Miſtakes of *Borelli*, though proper to be animadverted upon in this Place, yet do not directly relate to the principal Deſign of the preſent Head of this Diſcourſe, which is to ſhew, what Influence the Muſcle *FG* has upon the Extenders of the Joint *B*. But in this neither has he proceeded with ſufficient Caution: For having aſſigned to the Muſcle *FG* a Tenſion double to the Power, by which it is diſtended, he aſſumes the Muſcle to act upon the Point *F* with the whole Tenſion he aſcribes to it *, contrary to his own Principles, and to the Reaſon he gives for the Tenſion of the Muſcle's being double to the diſtending Power; that, as I have already remarked, being this, that the Muſcle acts upon the Point *F*, and the Point *F* reacts againſt the Muſcle, as much as the Power applied to the Muſcle acts upon its other Extremity.

THUS far of the firſt Caſe of Muſcles, which lie over a Plurality of Joints. It is now time to paſs to the ſecond, when the Joints, over which a Muſcle lies, bend the ſame way. For the explaining this, let *ABCD* be a compound Lever compoſed of three Arms *AB*, *BC*, *CD*. Let the Arm *AB* be fixed, the Weight *E* hung at the Extremity *D*, and ſupported by the Strings *FG*, *HI*; the String *FG* paſſing over the two Joints *B*, *C*, and the String *HI* over the Joint *B* only,



the remoteſt from the Extremity *D*. Then it has been ſhewn †, that the Joint *B* being fixed by the String *HI*, the other String *FG* is diſtended by the Weight *E*

* De mot. Animal. Part. I. Prop. LII. pag. 95.   † Pag. 13.

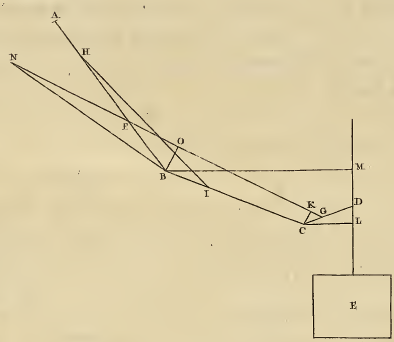
in

in the ſame Degree, as if that String were connected to the Arm *BC*, inſtead of *AB*; that is, *CK* being let fall from *C* perpendicular upon *FG*, and *CL* perpendicular to *DE*, the Line, in whoſe Direction the Weight *E* acts, the Tenſion of the String will be to the Weight *E* as *CL* to *CK*. It is required to find the Tenſion of the String *HI*. This *Borelli* affirms to be as great, as if there were no Joint in *C* to be ſuſtained by the String *FG*, but that *BCD* were one continued Arm of the Lever, and the String *FG* were removed *. What the Tenſion of the String *HI* really is, may be found thus. From the Point *B* let fall upon the Line *DE*, produced if needful, the perpendicular *BM*; and the Connection of the String *FG* being continued, let the String *FG* be produced beyond *F* in a right Line, till the Diſtance of its Extremity *N* from the Point *B* be equal to the Perpendicular *BM*. To the Lever let another Arm be added *BN*, turning upon the Center *B*, and connected to the String *GF* produced in *N*. Then is the new Arm *BN* equal to the Perpendicular *BM*. Let fall from *B* upon the String *FG* the Perpendicular *BO*, and to the Extremity of the Arm *BN*, and perpendicularly to it, let a Power be applied, whoſe Ratio to the Weight *E* ſhall be compounded of the Ratio's of *BO* to *BM* or *BN*, and of *CL* to *CK*. Then the Power in *N* will diſtend the String *NF*, and being applied perpendicularly to the Arm *BN*, and *BO* being a Perpendicular let fall upon the String *NF* produced, the Power applied in *N* will be to the Tenſion of the String *NF* as *BO* to *BN*: but as *CL* to *CK*, ſo is the Tenſion of the String *FG* to the Weight *E*. Therefore the two Ratio's of *BO* to *BN*, and of *CL* to *CK*, compound the ſame Ratio with that, which is compounded of the Ratio of the Power applied in *N* to the Tenſion of the String *NF*, and of the Ratio of the Tenſion of the String *FG* to the Weight *E*. But the Ratio of the Power in *N* to the Weight *E* is compounded of the Ratio of *BO* to *BN*, and of that of *CL* to *CK*. The Ratio therefore of the Power in *N* to the Weight *E*, is compounded of the Ratio of the Power applied in *N* to the Tenſion of the String *NF*, and of the Ratio of the Tenſion of the String *FG* to the Weight *E*. Again, the Ratio of the Power in *N* to the Weight *E* is compounded of the Ratio of the Power in *N* to the Tenſion of the String *NF*, and of the Ratio of the Tenſion of the String *NF* to the Weight *E*. The two Ratios therefore, that of the Power in *N* to the Tenſion of the String *NF*, and that of the ſame Tenſion of the String *NF* to the Weight *E*, compound the ſame Ratio with that, which is compounded of the Ratio of the Power applied in *N* to the Tenſion of the String *NF*, and of the Ratio of the Tenſion of the String *FG* to the Weight *E*. Take away the common Ratio of the Power applied in *N* to the Tenſion of the String *NF*, and as the Tenſion of the String *NF* to the Weight *E*, ſo will the Tenſion of the String *FG* be to the ſame Weight *E*. The Tenſion therefore of the String *NF* cauſed by the Power applied in *N* is equal to the Tenſion of the String *FG* cauſed by the Weight *E*. Wherefore the Point *F* of the String *NG* is drawn by the Power applied in *N* in the Direction *FN*, and by the Weight *E* in the oppoſite

* De mot. Animal. Prop. XLIV. pag. 79.

Direction

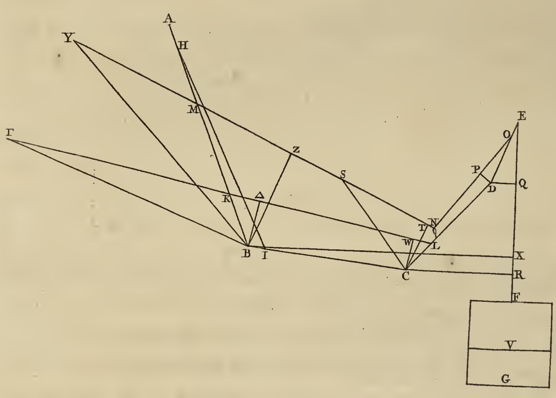
Direction FG with the ſame Force. So that if the Connection of the String NG with the Arm AB of the Lever in the Point F were looſed, yet the Point F of the String would be retained contiguous to the Arm AB by the Action of the Power applied in N. But ſince the Point F would remain in the ſame Place, whether connected to the Arm AB or not, it is evident that the String HI, by which the Arm BC is ſupported, will ſuffer the ſame Degree of Tenſion in both Caſes. And when the String NG is connected to the Arm AB in F, the Power applied in N cannot at all affect the Tenſion of either String: For it can have no Influence upon the Part FG of the String NG, or upon any Part of the Lever, except the fixed Arm AB. From all which it follows, that the Tenſion of the String HI will remain the ſame, whether the String FG be connected to the Arm AB in F, and the added Arm of the Lever BN be removed with the Power applied to it in N, or the Connection of the String FG with the Arm AB be looſed, the String continued to N; and being connected to the Arm BN, the Power required be applied to N. But now the compound Lever $NBCD$ will per-



form the Office of a Balance upon the Center B, and if the Power applied in N be equal to the Weight E, as it will be, if BO be to BM as CK to CL, the String HI will undergo no Degree of Tenſion; but the Machine would remain in *Æquilibrio* without it: if the Weight E exceed the Power in N, the Tenſion of the String HI will be that required to ſuſtain the Exceſs of the Weight E above the Power in N applied in the Point D, and Direction of DE. If the Power in N exceed the Weight E, the String HI ought to have a Degree of Rigidity ſufficient to hinder the Diminution of the Angle under ABC, by ſupporting the Exceſs of the Power in N above the Weight E applied at the Diſtance of BN or BM: or elſe a String muſt be inflected on the outſide of the Angle under ABC, which by its Tenſion ſhall ſupport the ſame Reſiſtance.

By this it appears, that in this Caſe, when a Muſcle lies over another Joint beſides that, whoſe Motion it principally preſides over, and the two Joints bend the ſame way, the Muſcle contributes to the Support of that other Joint, aſſiſting the Muſcles peculiar to that Joint; as in the other Caſe, when the Joints bend contrary ways, the Muſcle common to both Joints was found to augment the Tenſion of the others.

AND this is ſufficient to explain the Caſe of Muſcles, which paſs over two Joints; but when the Joints bend thus the ſame way, Muſcles are often obſerved to lie over more Joints than two: the Conſequence of which is to be collected much after the ſame manner. For this Purpoſe let *ABCDE* be a Lever compounded of four Arms *AB*, *BC*, *CD*, *DE* ſet together in three Joints *B*, *C*, *D*. Let the Arm *AB* be fixed, and the Weight *FG* ſuſpended at the Extremity *E*, the Arms *BC*, *CD*, *DE* ſupported by the three Strings *HI*, *KL*, *MNO*; the firſt of which *HI* ſhall lie over the Joint *B* only, the ſecond *KL* over two of the Joints *B* and *C*, and the third *MNO* over all three Joints *B*, *C*, and *D*, and beſides be inflected through a Nooſe at *N* connected to the Arm *CD*. It is required to find the Tenſion of each String.



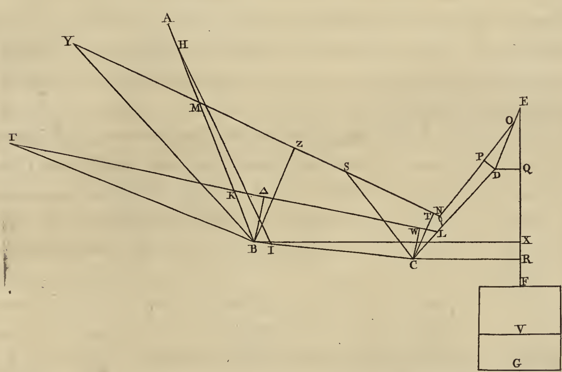
To begin with the String *MNO*, this being inflected, and paſſing freely through the Nooſe at *N*, both Parts of the String *MN*, and *NO* will receive the ſame Degree of Tenſion, but will not act, or rather reſiſt the Power acting againſt them in the ſame Direction, but each in that Direction in which it lies: So that the Arms of the Lever *BC*, *CD* being ſupported by the proper Strings, the String *MNO* will ſupport the Arm *DE* againſt the Weight *FG* in the Direction *NO*. Therefore from the Point *D* letting fall upon *NO* the Perpendicular *DP*, and the Perpendicular *DQ* upon the Line *EF*, in whoſe Direction the Weight *FG* acts,

acts, as *DP* to *DQ* so will the Weight *FG* be to the Tension of the String *MNO*. To find the Tension of the String *KL* let fall from the Point *C* the Perpendicular *CR*, and in the Joint *C* apply another Arm *CS* to the Lever, equal in length to the Perpendicular *CR*, and connected by its Extremity *S* to the String *MN*. Then if a Power be applied to *S*, as the String *NO* supports the Arm of the Lever *DE* in the Direction *NO*, so will the String *SN* support the Arm *CS* in the Direction *SN*. So that if the Power be applied in *S* perpendicularly to the Arm of the Lever *CS*, the Tension of the String *SN* by the Power applied in *S* will be to the Power applied in *S* as the Arm *CS* to the Perpendicular *CT* let fall from the Point *C* upon the String *SN*. Whence if the Power applied in *S* be taken to the Weight *FG* in the Ratio, which is compounded of the Ratio of *CT* to *CR*, and of that of *DQ* to *DP*, then the Tension of the String *SN* by the Power applied in *S* will equal the Tension of the String *NO* by the Weight *FG*. But the Part *SN* of the String *SNO* was before shewn to receive the same degree of Tension from the Weight *FG* as the Part *NO*, by reason of the free Communication of both Parts of the String through the Noose at *N*: So that the Part *SN* of this String will receive the same degree of Tension by the Weight *FG*, and by the Power applied in *S*. But the Directions of these two Tensions are contrary, that by the Weight *FG* being directed from *S* to *N*, and that by the Power applied in *S* from *N* to *S*; being equal therefore and contrary, they sustain, and counterbalance each other. Hitherto the String *SNO* has been supposed to be connected to the Arm *AB* of the Lever in the Point *M*; but the Part *SNO* being supported by these two contrary Powers in *Æquilibrio*, its Tension and Situation will remain the same, though the Connection of the String with the Arm *AB* be loosed. Hence it follows that the String *SNO* will contribute equally to the Sustension of the Arm *CD*, and the Tension of the String *KL* required for its entire Support will be the same; whether the String be sustained by the added Arm of the Lever *CS*, and the Power applied to it in *S*, or by the Connection of the String with the Arm *AB* in the Point *M*, the Arm *CS* and Power applied to it being removed; for the Arm *CS* has no Influence upon the Arms *CD*, or *DE*, but by the Intervention of the String *SNO*. But now the compound Lever *SCDE* performs the Office of a Balance suspended upon the Center *C*, *CS* and *CR* being equal; wherefore the String *KL* sustains the Excess of the Weight *FG* suspended in *E* above the Power applied in *S*. Take from the Weight *FG* the Portion *FV* equal to the Power applied in *S*, and let fall from the Point *C* upon the String *KL* the Perpendicular *CW*; then the Tension of the String *KL* will be to the Weight *VG* as *CR* to *CW*.

Thus is found the Tension of the String *KL*. To find the Tension of the String *HI* proceed thus. From the Center *B* let fall the Perpendicular *BX* upon the Line *EF*, and apply at the Center *B* a new Arm *BY* to the Lever, equal in length to the Perpendicular *BX*, and connected to the String *NM* produced beyond *M* by its Extremity *Y*. Then a Power being applied in *Y* perpendicularly to the Arm *BY*, this Power will be to the Tension of the String *MY* caused by

it,

it, as the Perpendicular *BZ*, which is let fall from *B* upon *ΥN*, to the Arm *BΥ*; and if the Power applied in *Υ* be to the Weight *FG* in the Ratio, which is compounded of the Ratio of *BZ* to *BX*, and of *DQ* to *DP*, the Tenſion of the String *MΥ* by the Power applied in *Υ*, and that of the String *MNO* by the Weight *FG* will be equal, and have a contrary Direction. So that this Power being applied in *Υ*, the String *ΥMNO* will preſerve the ſame Tenſion, and Poſition, whether connected to the Arm *AB* in *M*, or not. In like manner a new Arm *B*Γ being added to the Lever at the Joint *B* of equal length with the Perpendicular *BX*, and connected by its Extremity Γ to the String *LK* produced beyond *K*; if a Power be applied in Γ perpendicularly to the Arm *B*Γ, whoſe Ratio to the Weight *VG*, that being the whole Weight, againſt which the String *KL* acts, ſhall be compounded of the Ratio of *B*Δ, the Perpendicular let fall from *B* upon Γ*L*, to *BX*, and of *CR* to *CW*; then the String Γ*KL* ſhall preſerve the ſame Tenſion and Poſition, whether connected to the Arm *AB* in the Point *K*, or not. Therefore the Connections of the Strings *ΥMNO*, and Γ*KL* with the



Arm *AB* in *M*, and *K*; *BΥ*, *B*Γ, and *BX* being all equal, the Tenſion of the String *HI* will be that required to ſuſtain the Exceſs of the Weight *FG* above the Powers applied in *Υ*, and Γ. But if the Strings *ΥMNO*, Γ*KL* be connected in *M* and *K*, and the Powers applied to *Υ* and Γ be removed, the Tenſion of the String *KI* will be the ſame, becauſe the Powers applied in *Υ* and Γ have no other Effect upon the Strings *MNO*, *KL* but the ſupplying the Place of the Connections in *M* and *K*; nor any Influence upon the Arms *BC*, *CD*, *DE*, when the Strings are connected in *M* and *K*.

NOW from all which has been ſaid may be drawn this general Obſervation; That in theſe compound Levers, when a String lies over other Joints, beſides

ſides that it is principally deſigned to ſupport the part of the Weight ſuſpended at the Extremity of the Lever, which ſuch a String ſupports at any other Joint, is to the whole Weight in the Ratio compounded of the Ratio of the Perpendicular let fall from that Joint upon the Part of the String, which is in the Direction of its Action upon that Joint, to the Perpendicular let fall from the ſame Joint upon the Line, in whoſe Direction the Weight ſupported acts; and of the Ratio of the Perpendicular let fall upon this Line from the Joint, to whoſe Support the String principally contributes, to the Perpendicular let fall from this Joint upon the String.

THIS is the general Rule for determining the effects of Muſcles, which lie upon ſeveral Joints bending the ſame way; for ſuch Joints do perfectly reſemble the compound Levers, that have been now treated of. It next follows to apply the Rule to ſome particular Inſtances. And in the firſt place we may learn from hence the reaſon why the Flexor of the ſecond Internode of the Fingers is not double in bigneſs to the Flexor of the third, as according to *Borelli's* Doctrine it ought to have been; for the Examination of theſe Muſcles alone by the foregoing Rule ſhews us that the *Perforatus* needs not be much, if at all, greater than the *Perforans*; ſince we ſhall find that the Flexor of the third Internode ſupports near half the Action upon the ſecond Joint of any Power applied to the Extremity of the Finger, and acting perpendicularly againſt it; eſpecially if the Finger be in ſome meaſure bent, as moſt uſually it is in its ordinary Action. By the preceding Rule the Flexor of the third Internode ſupports a part of the Action of ſuch a Power againſt the ſecond Joint, and that Part bears to the whole Action upon that Joint, the Ratio compounded of the Ratio of the Perpendicular let fall from the Center, whereupon the ſecond Joint moves, upon the Tendon of the *Perforans* to the Perpendicular let fall from that Center upon the Line, in whoſe Direction the Power is applied to the end of the Finger, and of the Ratio of the diſtance of the Extremity of the Finger from the Center of the third Joint to the Perpendicular let fall from that Center upon the Tendon of the *Perforans*. But theſe two Ratios compound a Ratio not much differing from that of 1 to 2; ſo that the *Muſculus Perforans* ſupports about half the Action of the Power upon the ſecond Joint. But the Tenſion of the *Muſculus Perforatus* is to the Power againſt which it acts, as the Perpendicular let fall from the Center of the ſecond Joint upon the Line, in whoſe Direction the Power acts againſt the Extremity of the Finger, to the Perpendicular let fall from the ſame Center upon the Tendon of the Muſcle; and there remaining no more than about half the Weight for this Muſcle to act againſt, its Tenſion will be to the whole Weight as about half the firſt Perpendicular to the ſecond. But this Ratio, in the Situation of the Finger and of the Line of Direction the Power acts in, which we have here ſuppoſed, is little different from that of the diſtance of the Center of the third Joint from the end of the Finger to the Perpendicular let fall from that Center upon the Tendon of the *Perforans*; which latter Ratio is the ſame with that of the Tenſion of the *Perforans* to the whole

Power ſupported. Hence it appears, that in theſe Muſcles are required for the ordinary Actions of the Fingers no very different degrees of Tenſion; and conſequently the Muſcles themſelves on this Account ought to be about the ſame Size. It is further worth notice in this Place, that the *Perforatus* acts with ſomewhat greater advantage upon the ſecond Joint than the *Perforans* does; for the Tendon of the *Perforans* paſſing under that of the *Perforatus*, raiſes the latter to a greater diſtance from the Bone.

THUS far we ſee, that the Flexor of the ſecond Internode of the Finger needs ſcarce exceed the Flexor of the third; but the firſt of theſe Muſcles is found not only no greater than the other, but even conſiderably leſs; the reaſon whereof is to be drawn from another Conſideration, namely from the Structure and Diſpoſition of thoſe Muſcles, whoſe office it is to bend the firſt Joint of the Fingers. Theſe Muſcles are the *Lumbricales* and *Interoſſei*, which are partly inſerted into the firſt Bone of the Fingers, and partly form Tendons, which paſſing on the inner ſide of the firſt Joint, are united with the Tendons of the Extender of the Fingers, and accompany them through their whole length. By which Formation theſe Muſcles extend in ſome ſmall degree the ſecond Joint of the Fingers, and much more powerfully the third, and at the ſame time they are Flexors of the firſt Joint. As *Falloppius* made a very great Diſcovery in obſerving that theſe Muſcles extend the ſecond and third Joints of the Fingers *, ſo *Veſalius*'s Sentiment that they likewiſe bend the firſt Joint † ought not to be neglected, ſince there are no other Muſcles allotted to that Office, and yet without particular Flexors of this Joint the Motion of the Fingers would be imperfect; for if the preceding Rule be applied to the *Perforans* and *Perforatus* at the firſt Joint of the Finger, they will be found each to ſupport about one third part of the influence upon this Joint of the Power applied to the Extremity of the Finger; and will leave one third part to be ſupported by Muſcles proper to this Joint. But now theſe *Lumbricales* and *Interoſſei* by the forementioned Diſpoſition of their Tendons, while they bend the firſt Joint, act againſt the Benders of the ſecond and third, but chiefly againſt the Flexor of the third; inſomuch that the Flexor of the third Joint ought to bear a greater Proportion to the Flexor of the ſecond than would otherwiſe have been neceſſary. Moreover, the *Lumbricales* ariſe from the Flexor of the third Internode, whence this Muſcle ought to be ſtill larger, to enable it not only to execute its own office, but likewiſe to ſuſtain the *Lumbricales* in the Performance of theirs.

WHAT has here been ſhewn of the Muſcles of the Fingers contributing to the Support of all the Joints, over which their Tendons paſs, leads us to one great

* Obſerv. Anatom. in Oper. fol. 243.

† De corp. human. fabric. Lib. II. c. 43. & Obſerv. Fallop. examen. p. 71.

Deſign

Deſign in this Contrivance of laying Muſcles over ſeveral Joints, which is, that in thoſe Joints, which bend the ſame way together, the ſame Muſcle might be ſubſervient to more Joints than one. Thus the *Perforans*, beſides the third Joint of the Fingers, which it alone ſuſtains, aſſiſts in ſupporting not only the two other Joints of the Fingers, as has been ſaid, but likewiſe the Wriſt: The *Perforatus* beſides the ſecond and firſt Joints of the Fingers aſſiſts in ſupporting the Wriſt and Elbow Joint, it ariſing from the *Humerus*: and the *Lumbricales* have added to their Office of ſupporting the firſt Joint of the Fingers, another of aſſiſting the Flexors of the Wriſt.

THOUGH we find too, that a Muſcle may paſs over a Joint without ſenſibly contributing to the Motion of it, which I take to be nearly the Caſe of the *Palmaris longus*, and the two Flexors of the Wriſt in reſpect of the Joint of the Elbow. The *Palmaris* ariſes from the very Apex of the internal Tubercle of the *Humerus*; ſo that its Origin is juſt in the Axis, upon which the Joint moves, and therefore can have no effect upon it. The two *Flexores Carpi* take their Riſe from the ſame Tubercle of the *Humerus*, on each ſide the Head of the *Palmaris*, and contiguous to it: Wherefore they have their Origin ſo near to the Axis of the Joint, that their effect upon the Motion of it muſt be very inconſiderable. Beſides, the ſmall diſtance the Heads of theſe Muſcles have from the Axis of the Joint in the *Flexor radialis* is toward the Inſide, in the *Flexor ulnaris* toward the Outſide: And what the Muſcle which ariſes on the Inſide of the Axis, contributes to the Flexure of the Joint, that which lies on the Outſide will contribute to the Extenſion of it. So that when theſe Muſcles act together, as they do when they bend the Wriſt, or reſiſt to the Extenſion of it, they deſtroy each other's Action upon the Joint of the Elbow, and in this Caſe have more certainly little or no effect upon it.

HENCE it ſhould ſeem, that theſe Muſcles are laid over the Joint of the Elbow only for the more convenient Situation of them. Which probably is one Deſign likewiſe in giving the *Gaſterocnemius externus* its Riſe from the lower Head of the Thigh Bone; for that, as has been ſhewn, by paſſing over the Joint of the Knee makes a greater degree of Force neceſſary in the Muſcles of the Knee, which act with it, than would elſe be needful; ſo that this Muſcle is ſo far from aſſiſting to the Support of the Knee, that it has the contrary effect. Though another Intent may likewiſe be allowed of, which is, that the Muſcle, when both the Joints over which it lies, are extended, ſhould not be conſiderably ſhorten'd, and ſo preſerve the Force of its Action more entire. And this ſeems more evidently to be intended in the Flexors of the *Tibia*. For by an Experiment of *Borelli*, which ſhall preſently be more particularly ſpoke to, we find theſe Muſcles by being contracted to loſe conſiderably their Force *. But by giving them their Origin from the *Os*

* De mot. Animal. Part. I. cap. IX. pag. 51, 52.

Iſchii,

of the Thigh Bone; and ſuch a *Sinus* we find there. But becauſe the depreſſing the Tendons in ſuch a *Sinus* would in part fruſtrate the principal Deſign, namely that of removing the Tendons to the greateſt diſtance from the Axis of the Motion; to avoid this the *Patella* is placed under the Tendons, and connected to them, fitting the *Sinus* in the Thigh Bone, and ſo ſecuring the Tendons from ſliding off the Joint; and yet preſerving the diſtance of them from the Axis of Motion, nay increaſing it.

But as this Structure of the Knee augments the Action of the Extenders of the *Tibia*, ſo it will have the contrary effect upon the Flexors; for the oval Figure of the Heads of the Thigh Bone removing the Axis, upon which the Joint turns, toward the hinder Part of the Bone, places it nearer to the Tendons of the Flexors than it would otherwiſe be.

These are the Effects, the Structure of the Knee has upon the Muſcles, when the Joint is extended. As the Knee is bent, the oval Figure of the Heads of the Thigh Bone will force the Axis of Motion continually to recede backwards; which would cauſe it to approach the Tendons of the Flexors, and become nearer to them, when the Knee was bent, than when extended; but that thoſe Tendons are inſerted into the *Tibia* in ſuch a manner, as obliges them, at the ſame time the Axis approaches toward them, to riſe from the Joint; which they do ſo conſiderably, that their diſtance from the Axis of Motion, if not increaſed, does by no means ſeem to be diminiſhed by the Joint's being inflected. From hence may be drawn this Remark, as the Reſult of what has been here ſaid, that theſe Muſcles do not appear leſs conveniently ſituated to act upon the *Tibia* when the Knee is bent, than when extended; but that the Diminution of their Force is entirely to be aſcribed to the Alteration made in the Muſcles themſelves by being contracted, and that they loſe their abſolute Force in no leſs Proportion, than that in which the Weight applied to the Heel is diminiſhed.

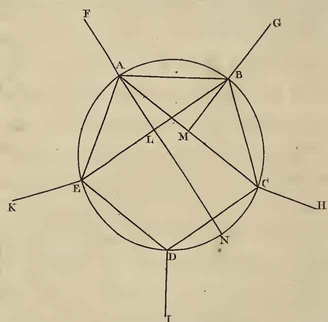
Why the Flexors of the Cubit do not in the ſame manner loſe part of their Action upon the Arm by the bending of the Elbow in the recited Experiment, but on the contrary have it augmented, comes next under Conſideration. And in the firſt place it is to be obſerved, that the *Os Femoris* in the Experiment upon the Flexors of the *Tibia* has the ſame Situation in reſpect of the *Os Innominatum*, from whence thoſe Flexors riſe, in both Caſes; but in the Experiment upon the Arm the *Humerus* does not preſerve in both Caſes the ſame Poſition with reſpect to the *Scapula*; being applied contiguous to the Side, when the Elbow is bent, and extended to a right Angle with the Trunk of the Body in the other Caſe. Upon this account the *Biceps*, one of the Flexors of the Arm, ariſing with both its Heads from the *Scapula*, will be no ſhorter with the Elbow bent, than with it extended; and therefore however its Force might diminiſh by its being ſhorten'd, in this Experiment, it will act with no leſs a degree of Force in one Caſe than in the other; nay,

nay, muſt act with greater Force, when the Elbow is bent, its Tendon riſing then a little from the Joint. *Borelli* does not ſay whether the Experiment was made with the Arm extended forward, or laterally, nor is it of great Importance to know that Circumſtance; for though the two Heads of the *Biceps* will not in both Caſes be at the ſame diſtance from the other Extremity of the Muſcle, yet are they ſo diſpoſed, that whenever one Part of the Muſcle is any thing relaxed, the other will be proportionally diſtended, one of theſe Heads paſſing on the Inſide, the other on the Outſide of the Shoulder Joint. Thus much of the *Biceps*. The *Brachiæus internus* ariſing from the *Humerus*, will by bending the Elbow be too much ſhortned to preſerve its Force entire, but muſt in all Probability be render'd ſo much weaker, as to make ſome farther Aſſiſtance neceſſary to move the Cubit with greater Force when bent, than when extended. For the Force of this Muſcle bears ſo great a Proportion to that of the *Biceps*, that the loſing any great part of the Action of this, if it does not leſſen the united Action of both, and diminiſh the Force with which the Arm is bent, muſt at leaſt ſo far abate their Force, as to render them incapable of ſupporting a Weight ſo much as a fourth Part greater in this Caſe than in the other, unleſs they be aſſiſted by ſome other Muſcle, which like the *Biceps* ſhould have its Force increaſed by the bending of the Arm, and be likewiſe ſo large, that the Action of the *Brachiæus internus* ſhall bear but a moderate Proportion to the whole Force with which the Arm is bent. Such a Muſcle I take to be that uſually called *Radii Supinator longus*, a large Muſcle, and without doubt a Flexor of the Arm; for it is to be perceived externally by the Touch to act very ſtrongly when the Arm is forcibly bent; and beſides, by having its Origin at a great diſtance from the Joint, it riſes when the Elbow is bent, very high from it; probably not a little more than is ſufficient to compenſate what Diminution it may ſuffer in its Action by being ſhorten'd.

THE Action of Muſcles lying over a Plurality of Joints having been thus largely explained, the firſt general Head of this Diſcourſe may now be brought to a Concluſion, by adding only a few Words concerning the Action of a ſort of Muſcles not employed in moving any ſolid Part. I mean the Sphincters; whoſe Action upon the Bodies included within them, I ſhall now explain.

LET *ABCDE* be a String in the Figure of a regular Polygon ſuſtained by Powers applied to each of its Angles *A*, *B*, *C*, *D*, *E* in the Direction of the Lines *AF*, *BG*, *CH*, *DI*, *EK*, making equal Angles each of them with the Sides of the Polygon including the Angle to which the reſpective Power is applied. I ſay in the firſt place the Powers are all equal, as likewiſe the Tenſion of every Side of the Polygon. Draw *EB* and produce *FA* to *L*; then the Angles under *FAB*, *FAE* being equal, for that is ſuppoſed, and the Power applied in *A* ſupported by the Tenſion of the Sides *AB*, *AE* of the Polygon, the Tenſion of *AB* is to half the Power applied in *A* as *AB* to *AL*. In like manner drawing *AC*, and producing *GB* to

to M, the Tenſion of AB is to half the Power applied in B as AB to BM. But becauſe the Figure $ABCDE$ is a regular Polygon, the Lines AL and BM are equal; the Power therefore applied in B is equal to that applied in A. In the ſame manner the Power applied in C will be equal to that in B, and ſo of the reſt. Wherefore the Powers applied in A, B, C, D, E are all equal one to another. But the Angles under FAE, FAB, GBA, GBC, HCB, HCD, IDC, IDE, KED, KEA are all equal, whence the Powers applied in A, B, C, D, E being equal, it is evident, that every Side of the Polygon will ſuffer an equal degree of Tenſion.



I say again, the Sum of all the Powers is to the Tenſion of the String, as the length of the String to the Semidiameter of the Circle circumſcribed about the Polygon.

Describe about the Polygon a Circle, and produce AL till it meet the Circumference in N; then is AN the Diameter of the Circle, becauſe it divides the Angle under EAB of the Polygon into two equal Parts; and BL is perpendicular to AN, therefore as AB to AL ſo NA to AB. But as AB to AL ſo is the Tenſion of the Side AB of the Polygon to half the Power applied in A. Whence as AN to AB ſo is the Tenſion of the Part AB of the String to half the Power applied in A. But as AB to the whole length of the String $ABCDE$, ſo half the Power applied to half the Sum of all the Powers, they being equal to one another, and equal likewiſe in Number to the Sides of the Polygon. Wherefore by Equality as AN the Diameter of the Circle to the length of the String, ſo is the Tenſion of the Part AB of the String, or the Tenſion of the whole String, for every Part of it has been ſhewn to be equally tenſe, to half the Sum of the Powers applied in A, B, C, D, E. And laſtly, as half the Diameter of the Circle to the length of the String, ſo is the Tenſion of the String to the Sum of all the Powers.

Farther,

FARTHER, if in the room of the Powers, paſſive Reſiſtances only be applied to the Points, *A*, *B*, *C*, *D*, *E*, and the String be endued with a Power of Contraction, the Force, the String contracts with, will be to the Force, impreſſed upon all the Reſiſtances, as the Tenſion of the String in the other caſe to the Sum of all the Powers, that is, as the Semidiameter of the circumſcribed Circle to the length of the String. But if the number of theſe Reſiſtances, and of the Sides of the Polygon be continually encreaſed without limit, the Polygon will at laſt coaleſce with the Circle circumſcribed, and the Length of the String will be the Circumference of that Circle. In this caſe therefore the Force of the String's Contraction will be to the Force, with which it acts upon Reſiſtances applied to every point of the Circumference of the Circle, or to its Preſſure upon the whole Surface of a Body, which ſhould adequately fill the Circle, as the Semidiameter of that Circle to its Circumference. And the Power, with which the String contracts, will be to the Force, with which any given Part of it acts upon the Body lodged in its Concavity, as the *Radius*, with which the Arch it is formed into is deſcribed, to the length of ſuch Part. Thus therefore may be determined the action of the Sphincters upon the Bodies they encompaſs.

PART II.

HAVING thus attempted to explain the effects of the Muſcles upon the Parts they are appointed to move, I ſhall now proceed to the other Head of my deſign, and make ſome enquiry about the cauſe, that contrάts the Muſcles, by taking into conſideration one or two of the moſt received opinions concerning that matter.

As it was obſerved at the beginning of this Diſcourſe, that the Muſcles conſiſt of two Parts, the Tendons and the fleſhy Fibres; whereof the fleſhy Parts only are found to ſuffer a change in the action of the Muſcle; therefore to diſcover the immediate cauſe of muſcular Motion, it appears neceſſary to enquire particularly into the Structure of theſe fleſhy Fibres.

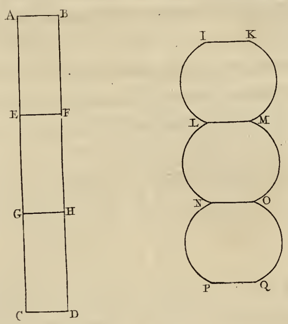
ACCORDINGLY moſt of the late writers upon this Subject have ſuppoſed theſe Fibres to be formed into Veſicles or Cells, whoſe inflation and diſtenſion by ſome fluid within them they conclude to be the cauſe, that contracts thoſe Fibres, and the Muſcle.

Now whereas this opinion has not been confirmed by any direct proofs, but is an Hypotheſis only, and well received on no account ſo much as the extreme difficulty of conceiving any other means that might ſo eaſily produce the effect under conſideration; our firſt ſtep ſhall be to examine what degree of probability may juſtly be allowed to this veſicular Structure of the muſcular Fibres; and afterwards we ſhall likewiſe conſider the moſt approved Conjectures, that have been made at the Cauſe, whereby the Juices contained in theſe Cells might be inflated. And ſince the veſicular Hypotheſis requires the Fibres, when contracted, to encreaſe in Thickneſs by the Enlargement of their Cavities, it ſhall firſt be ſhewn, what increaſe in theſe Cavities of the Fibres will be conſequent upon any propoſed degree of the Fibres Contraction; in order to make a judgment whether the Intumeſcence, that may ſeem neceſſary to be aſcribed to the Fibres and to the whole Muſcle upon this Principle, agrees with what is obſerved in the motion of the Muſcle.

BUT in order to this it muſt be firſt obſerved, that according to the degree of Contraction it ſhall be found neceſſary to aſſign to the Muſcles, theſe Cavities may be ſuppoſed differently formed. If it be deſired to give the Fibres as great a contractile Power as this Hypotheſis can admit of, we muſt ſuppoſe the Fibres to be compoſed of compleat Bladders connected together by a ſmall part only of their ſuperficies in the manner they are uſually delineated*: And upon this ſuppoſition the Fibre may contract into leſs than to half its length, as ſhall hereafter be ſhewn. But if a leſs degree of contraction be ſufficient to anſwer all the appearances of muſcular Motion, then the Fibres may be ſuppoſed hollow Cylinders

* Vid. Fig. 2, 3, 4, 5. in Jo. Bernoulli Diſſert. de Mot. Muſcul.

ders as *ABCD*, divided into cells as *ABFE*, *EFGH*, *GHDC*, either by tranſverſe membranes of ſufficient Strength, or by being inveſted at the proper Intervals by



annular Ligaments, that may hinder the parts they bind from yielding to the expanding Fluid, while the intermediate parts are protruded outwards, and the Fibre receive the Figure *IKLMNOPQ*.

In the next place we muſt enquire into what kind of Figure the ſides of theſe Veſicles will be expanded. The celebrated *John Bernoulli* attributes to them a circular Figure; but the calculations, upon which he grounds his aſſertion, are thus far deficient, that he conſiders theſe cells as plane Figures, and not as Solids made by the revolution of a plane Figure about an Axis, as they really are. Accordingly upon a ſtrict Enquiry we ſhall find this circular Figure ſomething diſtant from the truth. If the cells of the Fibres are diſtended by an included Fluid, it is evident that the Figure they muſt take, will be that, which will admit of the largeſt Cavity, that can be in any given diſtance between the Baſes of the Cells; and the Coats of theſe Cells being ſuppoſed to yield without reſiſtance to their dilatation in breadth, and only in length to remain undiſtendible, the Enlargement or Diminution will wholly depend upon the Figure of the Arch, into which their Sides are bent.

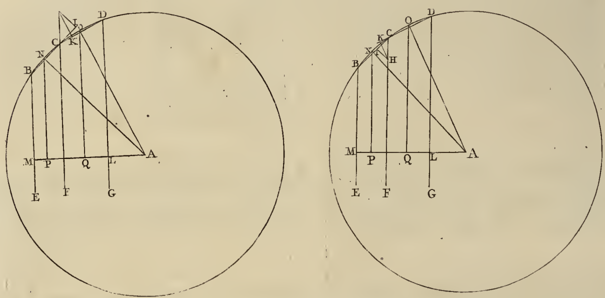
In order therefore to determine this Figure we muſt have recourſe to the Problem concerning iſoperimetrical Curves long ſince celebrated among the Geometers; ſo much of which Problem, as relates to our preſent purpoſe, ſhall here likewiſe be conſidered in the following Propoſitions.

PROPOSITION I.

THREE Points in the circumference of a Circle being given, and from them three parallel right lines being drawn, as likewiſe two Chords from the middle point to the two others; then if any point be taken in the middle parallel, from whence perpendiculars ſhall be let fall upon the Chords, I ſay, the Diſtances between the parallels being diminiſhed without limit, the ultimate *Ratio* of the Segment of the middle

middle parallel, intercepted between the point last assumed and the circumference of the Circle, to the difference between the Segments, cut off from the Chords by the perpendiculars let fall upon them, will be the same, as the *Ratio* of the semidiameter of the Circle to half the distance between the extreme parallels.

In the Circumference of a Circle whose Center is *A* let the three points assumed be *B*, *C*, *D*, and the three parallel right lines *BE*, *CF*, *DG*, as likewise the Chords *BC*, *CD*; Let *H* be the point taken in *CF* the middle parallel, the perpendiculars



HI, *HK* being let fall from this point *H*, upon the Chords *BC*, *CD*, cutting off from those Chords the Segments *CI*, *CK*. If the Distances between the parallels *BE*, *CF*, *DG* are diminished without limit, I say the ultimate *Ratio* of *CH* to the difference between *CI*, *CK* is the same with that of the semidiameter of the Circle to half the Distance between the parallels *BE*, *DG*.

Let *ALM* be drawn perpendicular to *DG*, *CF* and *BE*. Let the semidiameters *AN*, *AO* be drawn perpendicular to the Chords *BC*, *CD*, and let *NP*, *OQ* be drawn perpendicular to *AM*. This preparation being made, because *AN* and *HI* are both perpendicular to the same line *BC*, they are parallel; and *NP*, *HC* are also parallel, being likewise perpendicular to the same line *AM*, therefore the Angles under *ANP*, *IHC* are equal. Whence the rectangular triangles *IHC*, *NAP* are similar, so that *HC* shall be to *CI* as the semidiameter *AN* to *AP*: In like manner the triangles *OQA*, *HKC* are similar, and *HC* to *CK* as the semidiameter *AO* to *AQ*. Therefore because *HC* was to *CI* as the semidiameter *AN* to *AP*, it follows that *HC* is to the difference between *CI* and *CK* as the semidiameter of the Circle to *PQ*. But now the points *B*, *C* and *D* approaching without limit the ultimate *Ratio* of *PQ* to *ML* the distance between the parallels *BE*, *DG* will be that of 1 to 2, whence the ultimate *Ratio* of *HC* to the difference between *CI*, *CK* will be that of the semidiameter of the Circle to half the distance between the extreme parallels *BE*, *DG*.

PROPO-

PROPOSITION II.

TWO Curves, defcribed to the fame Abfciffe with their refpective Ordinates perpendicular to it, being fo related to each other, that every Ordinate of one Curve bear conftantly the fame relation to that Ordinate of the other Curve, which lies in a direct Line with it, independent on any other variable Magnitude; I fay if one of the Curves be of that Form, whereby the other Curve fhall comprehend a greater Space than if the firft Curve received any other Form, while it continued of the fame length, then this firft Curve fhall be concave towards the Axis, when the Ordinates of the two Curves encreafe together, otherwife it fhall be convex to its Axis.

LET the two Curves * be *AB*, *CD*, their common Abfciffe *EF*, the Perpendiculars to this Abfciffe, *AE*, *BF* being Ordinates in the Curve *AB*, and *EC*, *FD* Ordinates in the Curve *CD*; the adjoining Ordinates of the Curves *AB*, *CD* bearing conftantly the fame relation to each other independent on any other variable Magnitude; then let the Curve *AB* be of that Form, that the fpace *ECDF* fhall be greater than could be comprehended by a Curve generated from any other Curve paffing through the Points *A*, *B*, and of the fame length with the Curve *AB*, in the fame manner as the Curve *CD* is generated from this Curve *AB*: This being fuppofed, I fay, when the Ordinates of the two Curves bear fuch a relation to each other, that the greater Ordinates in one of the Curves correfpond to the greater Ordinates of the other, then the Curve *AB* is concave to the Axis *EF*; otherwife it is convex to it.

IF poffible let the Curve *AB* be convex to the Axis, when the Ordinates of the two Curves are fo related to each other as to increafe and decreafe together. Take in the Curve *AB* two Points *G*, *H*, and to the Abfciffe *EF* ordinately apply *GIK*, *HLM*. Divide *IL* into three equal parts in the Points *N*, *O*, ordinately applying *PNQ*, *ROS*. Join the Chords *GP*, *PR*, *RH*, and draw three other Lines *GT*, *TV*, *VH*, whofe fum fhall be equal to the fum of the three Chords *GP*, *PR*, *RH*; fo that *NT* be greater than *NP* and *OV* lefs than *OR*. Through the Points *G*, *T*, *V*, *H*, let fome Curve Line be defcribed equal in length to the Curve paffing through the points *G*, *P*, *R*, *H*, and let the Curve *KWXM* be generated from the Curve paffing through *G*, *T*, *V*, *H* in the fame manner as the Curve *KQSM* is generated from the Curve *GPRH*. Now the Curve *CD* being fo formed from the Curve *AB*, that the greater Ordinate in the Curve *CD* correfponds to the greater Ordinate in the Curve *AB*; *NP* being lefs than *NT*, *NQ* fhall be lefs than *NW*; and *OV* being lefs than *OR*, *OX* fhall be lefs than *OS*. Again, becaufe the fpace *ECKQSMDF* generated from the Curve *AGPRHB* is greater than the fpace

* Vid. Fig. Pag. xxxix.

generated in like manner from any other Curve drawn through the points A, B, of the ſame length with the Curve $AGPRHB$, the ſpace $ECKQSMDF$ is greater than the ſpace $ECKWXMDF$, and the ſpace $IKQSML$ greater than the ſpace $IKWXML$. In the next place, let the Points I, L approach without limit, and the ſpace $IKQSML$ will coaleſce with the ſpace included by the Lines KI, IL, LM, and the parabolical Line deſcribed by Sir *Iſaac Newton*'s Method of Differences through the Points K, Q, S, M; in like manner the ſpace $IKWXML$ will alſo coincide with the ſpace included by the Lines KI, IL, LM, and ſuch a parabolical Line deſcribed through the Points K, W, X, M. Therefore the ſpace contained by the parabolical Line paſſing through the Points K, Q, S, M is greater than that comprehended by the parabolical Line paſſing through the Points K, W, X, M. But the firſt of theſe parabolical ſpaces is one eighth part of the Rectangle under IL, and under the ſum of IK, LM together with three times the ſum of NQ, OS; likewiſe the latter parabolical ſpace is one eighth part of the Rectangle under IL, and under the ſum of IK, LM together with three times the ſum of NW, OX. Therefore the ſum of IK, LM together with three times the ſum of NQ, OS is greater than the ſum of IK, LM together with three times the ſum of NW, OX; and the ſum of NQ, OS is greater than the ſum of NW, OX; and in the laſt place, deducting OX and NQ, SX will be greater than QW. Again, NQ, NW, OS, OX bearing the ſame relation to NP, NT, OR, OV reſpectively, the Points N, O approaching without limit, when the ultimate *Ratio* of QW to SX is a *Ratio* of leſſer inequality, the ultimate *Ratio* of PT to VR ſhall likewiſe be a *Ratio* of leſſer inequality; that is, PT ſhall be leſs than RV. Farther, let PR, TV interſect each other in Y, and let HYZ be drawn; then between P and Z taking any Point Γ, let the three Lines $G\Gamma$, $\Gamma\Delta$, ΔH be drawn, whoſe ſum ſhall be equal to the ſum of the three Chords GP, PR, RH. Which being done, as it has now been proved, that when NT is greater than NP, and OV leſs than OR, PT is leſs than VR; ſo after the ſame manner it will appear, that $N\Gamma$ being leſs than NP, and $O\Delta$ greater than OR, $P\Gamma$ is greater than $R\Delta$. Moreover, let $\Gamma Y\Theta$ and ΘH be drawn; then PT being leſs than RV, $P\Gamma$ which is greater than $R\Delta$, ſhall be leſs than $R\Theta$, and therefore $R\Theta$ greater than $R\Delta$; and in the laſt place the ſum of the Lines $\Gamma\Delta$, ΔH greater than the ſum of the Lines $\Gamma\Theta$, ΘH, becauſe the point Θ falls within the Triangle made by the Lines $\Gamma\Delta$, ΔH and the right Line that would join the points Γ, H.

Now with the Center Y deſcribe the circular Arches $T\alpha\beta$, $V\varepsilon\zeta$; with the Center G deſcribe the Arch $T\eta\kappa$, GP being produced to η, and $G\Gamma$ to κ; laſtly, with the Center H deſcribe the Arch $V\lambda\mu$, HR being produced to λ, and $H\Theta$ to μ. Draw $\Gamma\xi$ parallel to GP, and the Chord $T\nu\xi$; then is $\Gamma\xi$ greater than $\Gamma\kappa$ and $P\nu$ leſs than $P\eta$; ſo that the *Ratio* of ΓT to TP, which is the ſame with the *Ratio* of $\Gamma\xi$ to $P\nu$, is greater than the *Ratio* of $\Gamma\kappa$ to $P\eta$. Likewiſe, drawing $P\pi$ parallel to ΓY, ſince $P\pi$ is greater than $P\alpha$, the *Ratio* of $\Gamma\beta$ to $P\alpha$ exceeds the *Ratio* of $\Gamma\beta$ to $P\pi$, and therefore yet more exceeds the *Ratio* ΓT to TP; in like manner

ner the *Ratio* of ΘV to VR is greater than the *Ratio* $\Theta\mu$ to $R\lambda$, and the *Ratio* of $\Theta\zeta$ to $R\varepsilon$ greater than the *Ratio* of ΘV to VR. Therefore becauſe ΓT is to TP as ΘV to VR, the *Ratio* of ΓT to TP is greater than the *Ratio* of the ſum of $\Gamma\varkappa$,

$\Theta\mu$ to the ſum of $P\eta$, $R\lambda$, and the *Ratio* of the ſum of $\Gamma\beta$, $P\alpha$ to the ſum of $\Theta\zeta$, $R\varepsilon$ greater than the *Ratio* of ΓT to TP. Whence the *Ratio* of the ſum of $\Gamma\beta$, $\Theta\zeta$ to the ſum of $P\alpha$, $R\varepsilon$ is greater than the *Ratio* of the ſum of $\Gamma\varkappa$, $\Theta\mu$

to

to the ſum of $P\eta$, $R\lambda$. But the ſum of GP, PR, RH being equal to the ſum of GT, TV, VH, and alſo GT equal to $G\eta$, TV equal to $\alpha\varepsilon$, and VH equal to $H\lambda$, deducting from the preceeding ſums the ſum of GP, TV and RH, there will remain the ſum of $P\alpha$, $R\varepsilon$ equal to the ſum of $P\eta$, $R\lambda$. Since therefore the *Ratio* of the ſum of $\Gamma\beta$, $\Theta\zeta$ to the ſum of $P\alpha$, $R\varepsilon$ is greater than the *Ratio* of the ſum of $\Gamma\kappa$, $\Theta\mu$ to the ſum of $P\eta$, $R\lambda$, the ſum of $\Gamma\beta$, $\Theta\zeta$ is greater than the ſum of $\Gamma\kappa$, $\Theta\mu$. Hence $\beta\zeta$ being equal to TV, $G\kappa$ equal to GT, and $H\mu$ equal to HV, if to both the preceeding ſums be added the ſum of $G\Gamma$, TV, ΘH, the ſum of $G\Gamma$, $\Gamma\Theta$ and ΘH will be found greater than the ſum of GT, TV and VH; which latter ſum is equal to the ſum of GP, PR and RH, equal to the ſum of $G\Gamma$, $\Gamma\Delta$, and ΔH: Therefore taking away $G\Gamma$ from the firſt and laſt of theſe ſums, there remains the ſum of $\Gamma\Theta$, ΘH greater than the ſum of $\Gamma\Delta$, ΔH; but it has been likewiſe ſhewn that the ſum of $\Gamma\Delta$, ΔH is greater than the ſum of $\Gamma\Theta$, ΘH, which is an abſurdity: Therefore the Curve AB is not convex to its Axis, when the Ordinates of the two Curves AB, CD increaſe and decreaſe together. And after the ſame manner is ſhewn that the Curve cannot be concave to its Axis, when the Ordinates in one of theſe Curves increaſe, while the Ordinates in the other decreaſe. It remains therefore that the Curve AB be concave to its Axis in the firſt caſe, and convex to it in the latter.

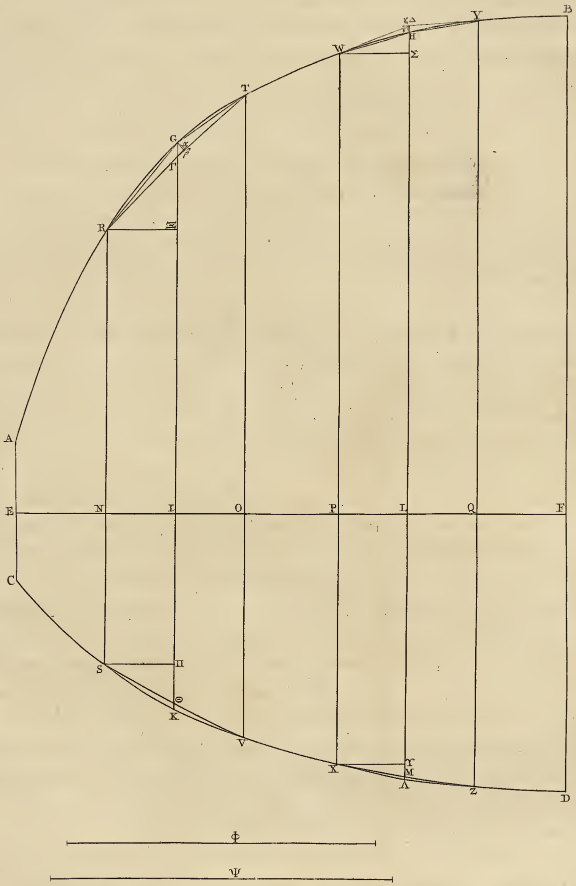
PROPOSITION III.

THE ſame things remaining as before, if one of the Curves includes the greateſt ſpace that can be included by a Curve generated in the manner propoſed from any Curve of the ſame length with the other; the *Ratio* of the *Radius* of the Curvature of this latter Curve in any point to the *Radius* of the Curvature in any other point, will be compounded of the *Ratio* of the *Momentum* of its Ordinate in the firſt point to the ſimultaneous *Momentum* of the correſpondent Ordinate of the former Curve, and of the *Ratio*, which the *Momentum* of the Ordinate in the former Curve correſponding to that Ordinate in the other Curve, which belongs to the ſecond point, bears to the ſimultaneous *Momentum* of that Ordinate in the other Curve.

LET the two Curves be AB, CD, their common Abſciſſe EF, the ſpace $ECDF$ the greateſt that can be included by any Curve ſo generated from a Curve paſſing through the points A, B, and equal in length to this Curve Line AB, that every Ordinate in the Curve CD bear conſtantly the ſame relation to the adjoining Ordinate of the Curve AB, independent on any other variable Magnitude. Let any two points G, H, be taken in the Curve AB, and the Ordinates GIK, HLM be drawn: Then I ſay the *Ratio* of the *Radius* of the Curvature in the point G to the *Radius* of the Curvature in the point H is compounded of the *Ratio* of the *Momentum* of IG to the ſimultaneous *Momentum* of IK, and of the *Ratio* of the *Momentum* of LM to the ſimultaneous *Momentum* of LH.

If

If poſſible let the *Ratio* of the Radius of the curvature in *G* to the Radius of the curvature in *H* be leſs than that which is compounded of theſe two *Ratios*. Take on each ſide the point *I* two points *N*, *O* equally diſtant from it, and at the ſame diſtance from the point *L* take on each ſide of it two points *P*, *Q*; then



draw the Ordinates *RNS*, *TOV*, *WPX*, *YQZ*. Now if the Intervals *IN*, *IO* are diminiſhed without limit, till they vaniſh, the Radius of the Curvature in the Point *G* will coincide with the Semidiameter of the Circle paſſing through the three Points *R*, *G*, *T*, and the Intervals *LP*, *LQ* being likewiſe diminiſhed without limit till they vaniſh, the Radius of the Curvature in the Point *H* will coincide with the Semidiameter of the Circle paſſing through the three Points *W*, *H*, *Y*.

If therefore the *Ratio* of the Radius of the Curvature in the Point G to the Radius of the Curvature in H be leſs than the *Ratio*, which is compounded of the *Ratio* of the *Momentum* of IG to the *Momentum* of IK, and of the *Ratio* of the *Momentum* of LM to the *Momentum* of LH, the *Ratio* of the Semidiameter of the Circle paſſing through the three Points R, G, T, to the Semidiameter of the Circle paſſing through W, H, Y will be leſs than the *Ratio* compounded of the two forementioned *Ratios*. Having drawn the Chords RG, GT, WH, HY, take in IG the Point Γ within the Concavity of the Arch RGT, and in LH on the convex Side of the Arch WHY take the Point Δ; ſo that $R\Gamma$, ΓT, $W\Delta$, ΔY being drawn, the Sum of $W\Delta$, ΔY ſhall exceed the Sum of WH, HY as much as the Sum of RG, GT exceeds the Sum of $R\Gamma$, ΓT; and moreover, that the *Ratio* of the Semidiameter of the Circle paſſing through the Points R, Γ, T to the Semidiameter of the Circle paſſing through W, Δ, Y ſhall likewiſe be leſs than that which is compounded of the two *Ratios* before mentioned, all which is evidently poſſible.

Now ſuppoſe two Arches to be deſcribed, one through the Points R, Γ, T, and the other through the Points W, Δ, Y, ſo that theſe Arches taken together ſhall be equal in length to the two Arches RGT, WHY taken together; and let two Arches $S\Theta V$, $X\Lambda Z$ be generated from theſe Arches paſſing through R, Γ, T, and through W, Δ, Y in the ſame manner as the Arches SKV, XMZ are generated from the Arches RGT, WHY. Then ſince the Curve Line $CSKVXMZD$ comprehends a greater Space than any Curve that can be generated from another Curve of the ſame length with the Curve $ARGTWHYB$, by the ſame Rule as theſe two Curves depend on each other; and ſince the Curve Line $ARGTWHYB$ is equal in length to the Curve Line $AR\Gamma TW\Delta YB$, the Space included by the Curve Line $CSKVXMZD$ will be greater than that comprehended under the Line $CS\Theta VX\Lambda ZD$, and conſequently the Space $SKV\Theta S$ greater than the Space $XMZ\Lambda X$: For by the preceding Propoſition the Point Γ being taken within the Concavity of the Curve AB, $I\Theta$ is leſs than IK, and the Point Δ falling on the convex Side of the Curve AB, LM is leſs than $L\Lambda$. But if the Points N, O and P, Q approach without limit till their Diſtance vaniſhes, the Curve Line SKV coincides with the Conic Parabola deſcribed to the Diameter IK through the three Points S, K, V; and the Curve $S\Theta V$ coincides with the like Parabola deſcribed to the ſame Diameter through the Points S, Θ, V; ſo likewiſe the Curve XMZ coincides with a Parabola deſcribed to the Diameter LM through the Points X, M, Z; and laſtly, the Curve $X\Lambda Z$ agrees with a Parabola drawn through the Points X, Λ, Z, and having the ſame Diameter $L\Lambda$. Hence the Space $SKV\Theta S$ being greater than the Space $XMZ\Lambda X$, and NO equal to PQ, $K\Theta$ is greater than $M\Lambda$.

Farther, draw $G\alpha$ perpendicular to $R\Gamma$, $G\beta$ perpendicular to ΓT, $H\varepsilon$ perpendicular to $W\Delta$, and $H\zeta$ perpendicular to ΔY, then $R\alpha$ is leſs than RG, and $T\beta$ leſs than TG; as likewiſe $W\varepsilon$ leſs than WH, and $Y\zeta$ leſs than YH. Therefore

fore the Exceſs of RGT above $R\Gamma T$ is greater than the Exceſs of the Sum of $R\alpha$, βT above $R\Gamma T$, that is greater than the Difference between $\Gamma\alpha$, $\Gamma\beta$; and the Exceſs of $W\Delta\Upsilon$ above $WH\Upsilon$ is leſs than the Exceſs of $W\Delta\Upsilon$ above the Sum of $W\varepsilon$, $\zeta\Upsilon$, or than the difference between $\Delta\varepsilon$, $\Delta\zeta$: Hence the Exceſs of RGT above $R\Gamma T$ being equal to the Exceſs of $W\Delta\Upsilon$ above $WH\Upsilon$, the difference between

$\Gamma\alpha$, $\Gamma\beta$ is leſs than the difference between $\Delta\varepsilon$, $\Delta\zeta$. Again, the Semidiameter of the Circle paſſing through the three Points R, Γ, T is to half NO as $G\Gamma$ to the difference between $\Gamma\alpha$, $\Gamma\beta$, and the *Ratio* of half PQ, equal to half NO, to the Semidiameter of the Circle paſſing through W, Δ, Υ is the ſame with the *Ratio* of the difference between $\Delta\varepsilon$, $\Delta\zeta$ to $H\Delta$, and therefore greater than the *Ratio* of the

difference

difference between $\Gamma\alpha$, $\Gamma\beta$ to $H\Delta$. Consequently by equality the *Ratio* of the Semidiameter of the Circle passing through the three Points R, Γ, T to the Semidiameter of the Circle passing through W, Δ, Υ is greater than the *Ratio* of $G\Gamma$ to $H\Delta$: and moreover, $K\Theta$ being greater than $M\Lambda$, the *Ratio* of the Semidiameter of the Circle passing through R, Γ, T to the Semidiameter of the Circle passing through W, Δ, Υ will still more exceed the *Ratio*, which is compounded of the *Ratio* of $G\Gamma$ to $K\Theta$, and of the *Ratio* of $M\Lambda$ to $H\Delta$.

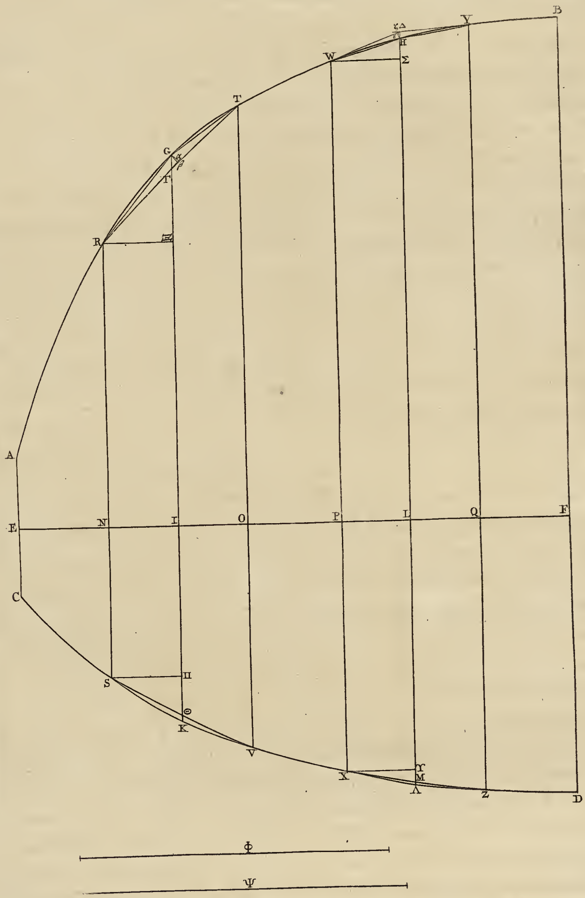
In the next place let $R\Xi$, $S\Pi$, $W\Sigma$, $X\Upsilon$ be drawn parallel to the Absciss EF; then because IG, $I\Gamma$, NR bear to IK, $I\Theta$, NS the same relation respectively without regard to any other variable Magnitude, the ultimate *Ratio* of $G\Gamma$ to $K\Theta$ will not differ from the ultimate *Ratio* of $G\Xi$ to $K\Pi$. For the same reason the ultimate *Ratio* of $M\Lambda$ to $H\Delta$ will not differ from the ultimate *Ratio* of $M\Upsilon$ to $H\Sigma$. Hence the *Ratio* of the Semidiameter of the Circle passing through R, Γ, T to the Semidiameter of the Circle passing through W, Δ, Υ being greater than the *Ratio* compounded of the *Ratio* of $G\Gamma$ to $K\Theta$, and the *Ratio* of $M\Lambda$ to $H\Delta$ the same will be greater than the *Ratio* compounded of the ultimate *Ratio* of $G\Xi$ to $K\Pi$, and of the ultimate *Ratio* of $M\Upsilon$ to $H\Sigma$, the ultimate *Ratio* of $G\Xi$ to $K\Pi$ being that of the *Momentum* of IG to the simultaneous *Momentum* of IK, and the ultimate *Ratio* of $M\Upsilon$ to $H\Sigma$ being that of the *Momentum* of LM to the simultaneous *Momentum* of LH. But it was said above, that the *Ratio* of the Semidiameter of the Circle passing through R, Γ, T to the Semidiameter of the Circle passing through W, Δ, Υ was less than the *Ratio* compounded of the *Ratio* of the *Momentum* of IG to the simultaneous *Momentum* of IK, and of the *Ratio* of the *Momentum* of LM to the simultaneous *Momentum* of LH; which is a Repugnancy.

Therefore the *Ratio* of the Radius of the Curvature in G to the Radius of the Curvature in H is not less than the *Ratio* compounded of the *Ratio* of the *Momentum* of IG to the simultaneous *Momentum* of IK, and of the *Ratio* of the *Momentum* of LM to the simultaneous *Momentum* of LH. And for the same reason neither is the *Ratio* of the Radius of the Curvature in H to the Radius of the Curvature in G less than the *Ratio* compounded of the *Ratio* of the *Momentum* of LH to the simultaneous *Momentum* of LM, and of the *Ratio* of the *Momentum* of IK to the simultaneous *Momentum* of IG. Whence the Proposition is manifest.

PROPOSITION IV.

THE same things remaining, I say the Radius of the Curvature in every Point of the Curve AB is to one and the same Line as the *Momentum* of its Ordinate in that Point to the simultaneous *Momentum* of the correspondent Ordinate in the Curve CD.

If not, let the Radius of the Curvature in the Point G be to the Line Φ as the *Momentum* of the Ordinate IG to the ſimultaneous *Momentum* of the Ordinate IK, and the Radius of the Curvature in the Point H be to ſome other Line Ψ as the *Momentum* of the Ordinate LH to the ſimultaneous *Momentum* of the Ordinate LM; then the *Ratio* of the Radius of the Curvature in G to the Radius of the



Curvature in H not being compounded of the *Ratio* of the firſt Radius to Φ, and of the *Ratio* of Ψ to the ſecond Radius, the ſame will not be compounded of the *Ratio* of the *Momentum* of IG to the ſimultaneous *Momentum* of IK, and of the *Ratio* of the *Momentum* of LM to the ſimultaneous *Momentum* of LH; which is abſurd.

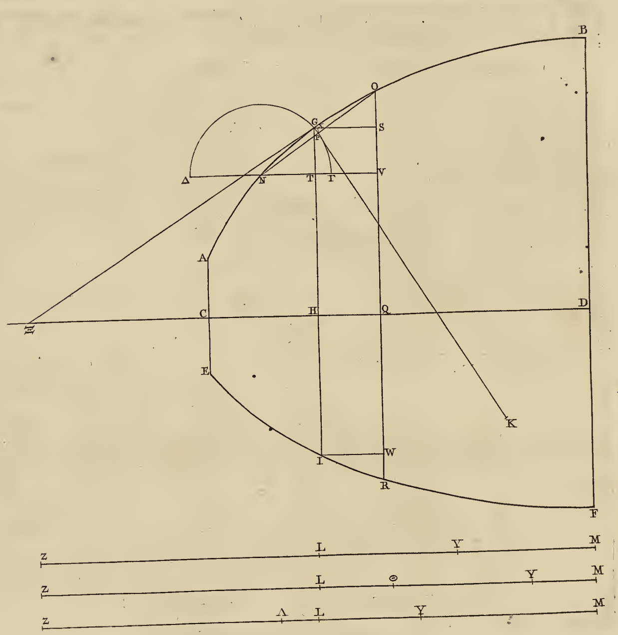
PROPOSITION V.

IN the Curve, which of all Curves of the ſame length with it ſelf generates the greateſt Space in the manner before ſpecified, to aſſign the relation between the *Momentum* of the Curve, of its Ordinate, and of its Abſciſſe.

LET the Curve be AB, the Abſciſſe CD, the Space generated from it $CEFD$. Any point G being taken in the Curve AB, ordinately apply GHI, and draw GK the Radius of the Curvature in the point G; then this Radius of the Curvature will be to ſome certain Line, which in every point of the Curve AB is the ſame, ſuppoſe to the Line LM, as the *Momentum* of the Ordinate GH to the ſimultaneous *Momentum* of the correſpondent Ordinate HI. Take in the Curve AB the points N, O equally diſtant from G, drawing NPO, ordinately applying OQR to the Abſciſſe CD, and drawing GS, NTV, IW parallel to CD, as alſo Px parallel to GH. This being done, if the points N, O approach to G, till their diſtance from it vaniſhes, the ultimate *Ratio* of twice GK to GO will be the ſame with the ultimate *Ratio* of OG to GP; but the ultimate *Ratio* of OG to OS is the ſame with the *Ratio* of GP to Gx; therefore by Equality the ultimate *Ratio* of twice GK to OS is the ſame as the ultimate *Ratio* of GO to Gx, and by Permutation the ultimate *Ratio* of twice GK to GO is the ſame as the ultimate *Ratio* of OS to Gx; as alſo, GK being to twice GK as Gx to twice Gx, by Equality the ultimate *Ratio* of GK to GO is the ſame as the ultimate *Ratio* of OS to twice Gx. Again, the ultimate *Ratio* of OS to WR is the *Ratio* of the *Momentum* of GH to the ſimultaneous *Momentum* of HI; therefore becauſe GK, the Radius of the Curvature in the point G, is to LM as the *Momentum* of GH to the *Momentum* of HI, GK will be to LM in the ultimate *Ratio* of OS to RW, and by Inverſion LM will be to GK in the ultimate *Ratio* of RW to OS; but the ultimate *Ratio* of GK to GO has been proved to be the ſame with the ultimate *Ratio* of OS to twice Gx; therefore by Equality the ultimate *Ratio* of LM to GO will be the ſame with the ultimate *Ratio* of RW to twice Gx. But moreover, NG and GO being equal, NP and PO are likewiſe equal; inſomuch that xS is equal to half NV, and Gx equal to half the Difference between NT and GS. Whence if the point G be ſuppoſed to flow, and the Curve AG to increaſe uniformly, the ultimate *Ratio* of OS to Gx will be that of the *Momentum* of GH to half the momentaneous Increment or Decrement of NT, and the ultimate *Ratio* of RW to twice Gx will be that of the momentaneous Increment or Decrement of HI to the momentaneous Increment or Decrement of NT. Now whereas it has been demonſtrated that the Curve AB is concave towards its Abſciſſe, when the Ordinates GH, HI increaſe or decreaſe together, but convex towards its Abſciſſe, when one of theſe Ordinates increaſes at the ſame time that the other decreaſes, it is evident that NT and HI in every Caſe increaſe and decreaſe together. But moreover, if the Curve AG increaſes uniformly, the ultimate *Ratio* of LM to GO will

be

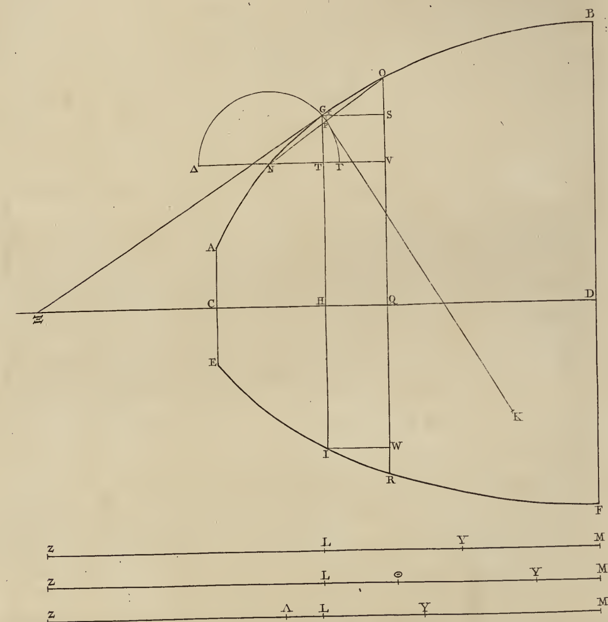
be always the ſame; therefore, ſince the ultimate *Ratio* of *LM* to *GO* is the ſame with the ultimate *Ratio* of *RW* to twice *Gx*, or with the *Ratio* of the *Momentum* of *HI* to the *Momentum* of *NT*, all which appears from what has been ſaid above; it follows that the ultimate *Ratio* of *LM* to *GO*, may either be the ſame with the ultimate *Ratio* of *HI* to *NT*; or the ſame with the ultimate *Ratio* of *HI* together with ſome given Line to *NT*; or laſtly, the ſame with the ultimate *Ratio* of the Exceſs of *HI* above ſome given Line to *NT*.



In the firſt place let the ultimate *Ratio* of *LM* to *GO* be the ſame with the ultimate *Ratio* of *HI* to *NT*. Take *LΥ* equal to *HI*; then the ultimate *Ratio* of *LM* to *GO* or *GN* will be the ſame with the ultimate *Ratio* of *LΥ* to *NT*, and by Permutation the *Ratio* of *LM* to *LΥ* will be the ſame with the ultimate *Ratio* of *GN* to *NT*; therefore *LZ* being made equal to *LM* by Compoſition and Diviſion, the *Ratio* of *ZΥ* to *ΥM* will be the ſame with the ultimate *Ratio* of the Sum of *GN* and *NT* to the Difference between them. But the Semicircle Δ*GT* being deſcribed to the Center *N*, it appears that *GT* is a mean Proportional between Δ*T* and *T*τ, that is between the Sum and Difference of *GN* and *NT*. Hence the *Ratio* of *ZΥ* to *ΥM* is duplicate of the ultimate *Ratio* of the Sum of *GN* and *NT* to *GT*, and alſo duplicate of the ultimate *Ratio* of *GT* to the Difference

ference between BN and $N\Upsilon$; that is, the *Ratio* of $Z\Upsilon$ to ΥM is duplicate of the *Ratio* of the Sum of the *Momentum* of the Curve AG, and of the Abſciſſe CH to the *Momentum* of the Ordinate HG; and the ſame *Ratio* alſo duplicate of the *Ratio* of the *Momentum* of the Ordinate HG to the Difference between the *Momentum* of the Curve AG, and of the Abſciſſe CH. And thus is the relation between theſe *Momenta* aſſigned in this firſt Caſe.

In the next place, let the ultimate *Ratio* of LM to GO be the ſame with the ultimate *Ratio* of HI together with ſome given Line to $N\Upsilon$. Let this given



Line be $L\Theta$, and take $\Theta\Upsilon$ equal to HI. Then will the ultimate *Ratio* of LM to GO or GN likewiſe be the ſame with the ultimate *Ratio* of $L\Upsilon$ to $N\Upsilon$, and as before taking LZ equal to LM, the *Ratio* of $Z\Upsilon$ to ΥM will be duplicate of the *Ratio* of the Sum of the *Momentum* of the Curve AG and of the Abſciſſe CH to the *Momentum* of the Ordinate HG, and the ſame *Ratio* alſo duplicate of the *Ratio* of the *Momentum* of the Ordinate HG to the Difference between the *Momentum* of the Curve AG and of the Abſciſſe CH. Thus the relation of theſe *Momenta* is aſſigned in this ſecond Caſe.

Lastly,

LASTLY, let the ultimate *Ratio* of LM to GO be the ſame with the ultimate *Ratio* of the Exceſs of HI above ſome given Line to NT. Let $L\Lambda$ be that Line, and $\Lambda\Upsilon$ be taken equal to HI; then is the ultimate *Ratio* of LM to GO or GN in like manner the ſame with the ultimate *Ratio* of $L\Upsilon$ to NT; and as before, LZ being taken equal to LM, the *Ratio* of $Z\Upsilon$ to ΥM is duplicate of the *Ratio* of the Sum of the *Momentum* of the Curve AG and of the Abſciſſe CH to the *Momentum* of the Ordinate HG; the ſame *Ratio* being alſo duplicate of the *Ratio* of the *Momentum* of the Ordinate HG to the Difference between the *Momentum* of the Curve AG and of the Abſciſſe CH. And hence the relation between theſe *Momenta* is aſſign'd in this laſt Caſe.

COROLLARY.

IF $G\Xi$ be drawn to touch the Curve AB in the point G; becauſe the ultimate *Ratio* of LM to GO is the ſame with the ultimate *Ratio* of $L\Upsilon$ to NT, and by Permutation LM to $L\Upsilon$ in the ultimate *Ratio* of GO to NT, $G\Xi$ will be to $H\Xi$ as LM to $L\Upsilon$.

THUS much concerning Iſoperimetrical Curves in general will ſuffice for our preſent Purpoſe; as to what farther relates to theſe Curves, the great Geometers, who have already treated of them, may be conſulted *. I ſhall now proceed forthwith to apply what has been here delivered to the Subject under Conſideration.

PROPOSITION VI.

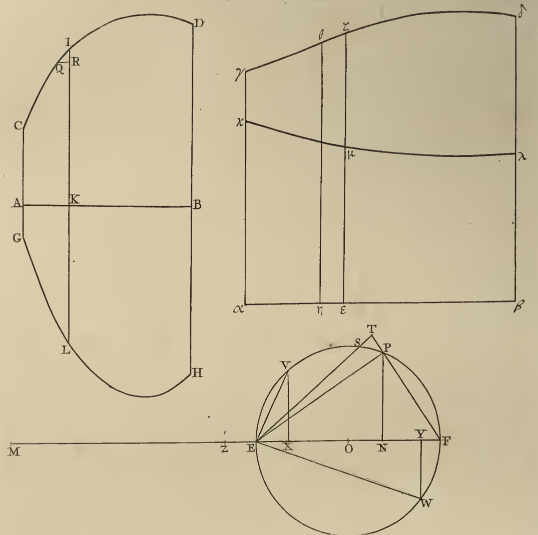
TO a given Axis to deſcribe a Curve through two given Points, ſo that Perpendiculars being let fall from thoſe Points upon the Axis, the Space included by thoſe Perpendiculars, by the Axis, and by the Curve to be deſcribed, ſhall generate in revolving round the Axis a greater Solid, than can be generated by any Space included under the ſame Axis, the ſame Perpendiculars, and any other Curve Line of the ſame length with the Curve to be deſcribed, and paſſing through the ſame given Points.

LET the given Axis be AB, the Points given C, D, from whence are drawn CA, DB perpendicular to the Axis, and let it be required to deſcribe the Curve CD having the Property here ſpecify'd.

* The two *Bernoulli*'s and Dr. *Taylor*.

 TAKE

Take at pleaſure the Line EF, and let the Curve GH be ſuch, that any point I being taken in the Curve CD, and the Ordinate IKL being drawn, the Rectangle under KL, and a Line equal to half the Circumference of the Circle deſcribed with the Radius EF be equal to the Circle deſcribed by IK in the Revolution



of the Space $ACDB$ about the Axis AB. Then the ſolid generated by the Revolution of the ſpace $ACDB$ about AB ſhall be equal to the Solid whoſe Baſe is the Space $AGHB$, and Altitude equal to half the forementioned Circumference. And whereas the Solid generated by the Curve CD, is to be greater than the Solid generated in like manner by any other Curve drawn through the Points C, D, of the ſame Length with CID; therefore the Solid whoſe Baſe is the Space $AGHB$, and Altitude that now mentioned, and conſequently the Space it ſelf $AGHB$, muſt be greater than can be produced by Curves derived from any other Curve paſſing through the Points C, D, and of the ſame Length with the Curve CD, thoſe Curves being derived from ſuch a Curve in the ſame manner as the Curve GH is derived from the Curve CD. Moreover, becauſe the Circle deſcribed by IK is equal to the Rectangle under IK, and a Line equal to half the Circumference deſcribed by the Point I, and the Circumferences of Circles are proportional to their Diameters; ſince the Circle deſcribed by IK is equal to the Rectangle under KL, and half the Circumference of a Circle whoſe Radius is EF, therefore the Square of IK will be equal to the Rectangle under KL and EF. But becauſe the Space $AGHB$ is greater than any other, that can be comprehended by Curves deduced as aforeſaid from any other Curve of equal Length with CD; if any Point

M

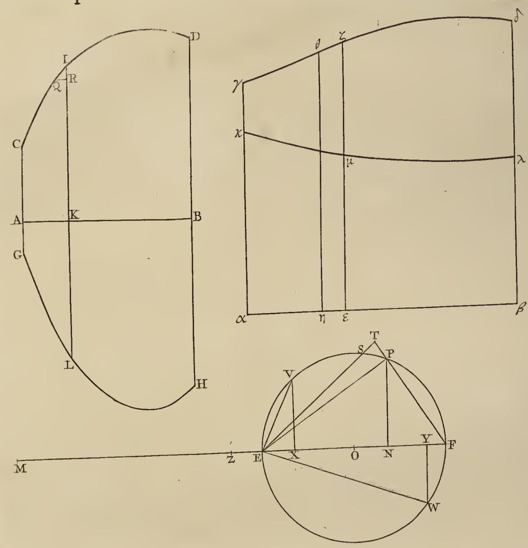
M be taken in the Line FE, and EN be taken equal to KL, the momentaneous Increment of the Sum of DI and BK may be to the *Momentum* of KI in the ſubduplicate *Ratio* of MN to NF; and the *Ratio* of the *Momentum* of IK to the *momentaneous* Increment of the Difference between DI and BK ſubduplicate of the ſame.

Upon EF as a Diameter deſcribe a Circle, its Center being O, erect NP perpendicular to EF, drawing EP. Then becauſe the Square of IK is equal to the Rectangle under KL, EF, and the Square of EP equal to the Rectangle under FEN; EN being taken equal to KL, EP ſhall be equal to KI. Farther, take in the Curve DI the point Q, and draw QR parallel to AB, and likewiſe in the Circle EPF, draw ES equal to KR, and alſo FPT.

Now it has been declared, that the ultimate *Ratio* of the Sum of IQ and QR to IR may be taken ſubduplicate of the *Ratio* of MN to NF, and the ultimate *Ratio* of IR to the Difference between IQ and QR ſubduplicate of the ſame. But if the Points S and P approach without Limit, the ultimate *Ratio* of EP to ET ſhall be the *Ratio* of Equality, and ST equal to IR, becauſe the Angle under EPF in the Semicircle is a right one. Hence the ultimate *Ratio* of the Sum of IQ and QR to ST may be ſubduplicate of the *Ratio* of MN to NF. But the ultimate Ratio of ST to PS is the ſame with the *Ratio* of PF to FE, by reaſon that the Triangle TPS, when it vaniſhes, becomes ſimilar to the Triangle FEP; and NF being to FP as PF to FE, the *Ratio* of PF to EF is ſubduplicate of the *Ratio* of NF to FE; therefore the ultimate *Ratio* of ST to PS is ſubduplicate of the *Ratio* of NF to FE. Whence when the ultimate *Ratio* of the Sum of IQ and QR to ST is ſubduplicate of the *Ratio* of MN to NF, by Equality the ultimate *Ratio* of the Sum of IQ and QR to PS will be ſubduplicate of the *Ratio* of MN to EF.

Now in the Circle EPF draw EV equal to AC, and EW equal to BD, letting fall the Perpendiculars VX and WY. Then taking the Line $\alpha\beta$ equal to the Arch VFW, erect the Perpendiculars $\alpha\gamma$, $\beta\delta$, that $\alpha\gamma$ be a mean proportional between MX and EF, and $\beta\delta$ a mean proportional between MY and EF. Moreover, taking $\beta\varepsilon$ equal to the Arch WFP, and the Perpendicular $\varepsilon\zeta$ equal to the mean proportional between MN and EF, deſcribe the Curve $\gamma\zeta\delta$, that ſhall paſs through all the Points found in the ſame manner as ζ. This being done, take $\varepsilon\eta$ equal to PS, and erect $\eta\theta$. And ſince the ultimate *Ratio* of the Sum of IQ, QR to PS may be ſubduplicate of the *Ratio* of MN to EF, it may be the ſame with the *Ratio* of $\varepsilon\zeta$ to EF, this laſt *Ratio* being ſubduplicate of the *Ratio* of MN to EF, by reaſon that $\varepsilon\zeta$ is the mean proportional between MN and EF. But when the ultimate *Ratio* of the Sum of IQ, QR to PS is the ſame with the *Ratio* of $\varepsilon\zeta$ to EF, the Rectangle under EF and the Sum of IQ, QR will be equal to the Rectangle under $\varepsilon\zeta$ and PS or $\varepsilon\eta$, when theſe Rectangles vaniſh.

nish. Consequently the Rectangle under EF and the Sum of DI, BK is equal to the Space $\beta\delta\zeta\varepsilon$. And thus may be assigned the Sum of any Portion of the Curve and of the Correspondent Abscisse.



Again, the ultimate *Ratio* of the Sum of IQ, QR to IR being subduplicate of the *Ratio* of MN to NF, and the ultimate *Ratio* of IR to the Difference between IQ, QR subduplicate of the same; the ultimate *Ratio* of the Sum of IQ, QR to the Difference between them is the same as the *Ratio* of MN to NF, and by Composition the ultimate *Ratio* of the Sum of IQ, QR to twice IQ the same with the *Ratio* MN to MF; and likewise, if MF be divided into two equal Parts in Z, the ultimate *Ratio* of the Sum of IQ, QR to IQ will be the same with the *Ratio* of MN to ZF. But the ultimate *Ratio* of the Sum of IQ, QR to IR being the subduplicate of the *Ratio* of MN to EF, and $\varepsilon\zeta$ the mean proportional between MN and EF, the ultimate *Ratio* of IR to the Sum of IQ, QR will be the same with the *Ratio* of $\varepsilon\zeta$ to MN; therefore since the ultimate *Ratio* of the Sum of IQ, QR to IQ is the same with the *Ratio* of MN to ZF; by Equality the ultimate *Ratio* of IR or PS to IQ will be the same with the *Ratio* of $\varepsilon\zeta$ to ZF.

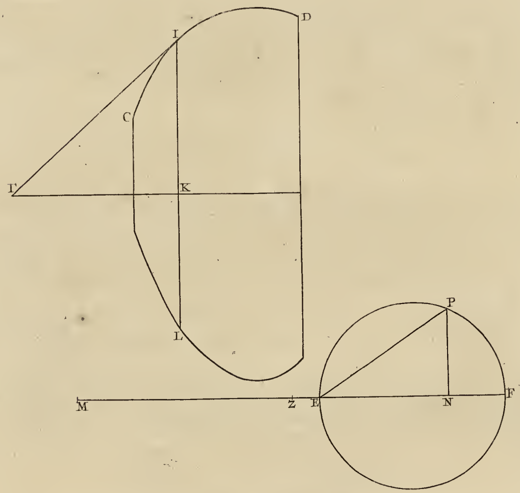
Therefore let $\alpha\kappa$ be taken to EF as ZF to $\alpha\gamma$, $\beta\lambda$ to EF as ZF to $\beta\delta$; likewise $\varepsilon\mu$ to EF as ZF to $\varepsilon\zeta$, and let the Curve $\kappa\mu\lambda$ be described, that shall pass through all the points found as μ. Which being done, since the ultimate *Ratio* of PS or $\varepsilon\eta$ to IQ is the same with the *Ratio* of $\varepsilon\zeta$ to ZF, it will be the same with the *Ratio* of EF to $\varepsilon\mu$, and the Rectangle under $\varepsilon\eta$, $\varepsilon\mu$, or the Space $\eta\mu$, equal

equal to the Rectangle under EF, IQ; ſo that the Space $\beta\varepsilon\mu\lambda$ will be equal to the Rectangle under EF and DI. Thus may be found the Length of any Portion DI of the Curve DC correſponding to any given Ordinate IK, as before was aſſigned the Sum of the Curve DI and of its Abſciſſe BK.

HENCE to any given Ordinate IK the correſpondent Abſciſſe BK may be found; and the Curve commodiouſly be deſcribed; the Spaces $\alpha\gamma\delta\beta$, $\alpha\kappa\lambda\beta$ being meaſured by Sir *Iſaac Newton*'s Method of Differences with great Facility.

COROLLARY I.

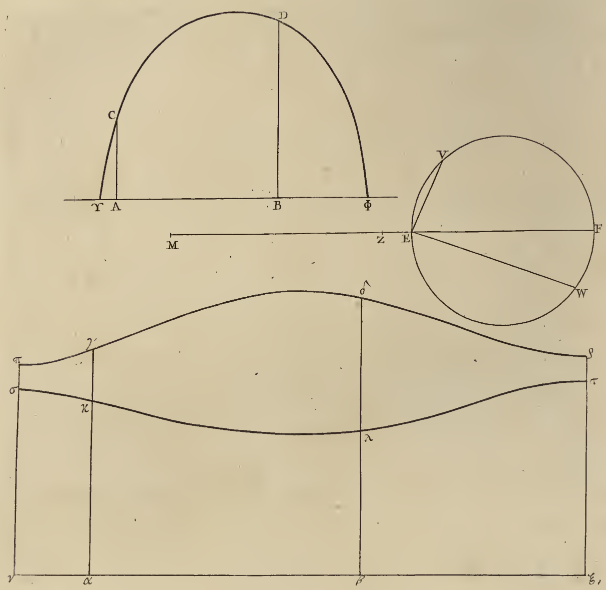
MF being divided into two equal Parts in Z; ſince EN is equal to KL, if



$I\Gamma$ be drawn to touch the Curve CD in I, $I\Gamma$ ſhall be to ΓK as ZF to ZN.

COROLLARY II.

If $\alpha\beta$ be produced both ways, that $\alpha\nu$ be equal to the Arch VE, and $\beta\xi$ e-



qual to the Arch WE, compleating the Curves $\pi\gamma\delta\rho$, $\sigma\kappa\lambda\tau$, the Curve CD may be continued on both Sides to the Axis in Υ and Φ.

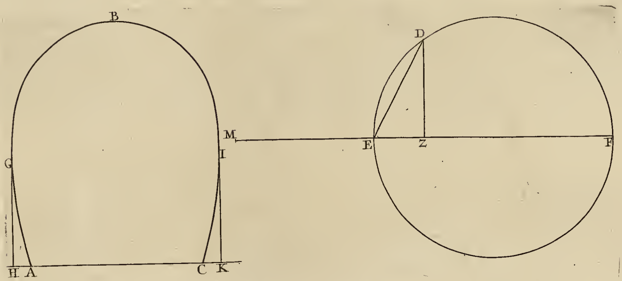
COROLLARY III.

If ME be greater than EF, ſo that Z fall without the Circle, the right Lines that touch the Curve ΥCDΦ in Υ and Φ ſhall make with the Axis an acute Angle towards the Curve; the Coſine of which Angle will be to the Radius as ZE to ZF. If ME be leſs than EF the ſame Angle ſhall be obtuſe; but the Coſine thereof to the Radius in the ſame Proportion as before. Laſtly, if ME be equal to EF the Tangents of the Curve in Υ and Φ ſhall be perpendicular to the Axis.

COROLLARY

COROLLARY IV.

When ME is lefs than EF an Ordinate may be drawn on each Side the Curve, that fhall touch it. Let ABC be a Curve defcribed with ME lefs than



EF; from the Point Z erect the perpendicular ZD and draw ED; then each of the Ordinates GH, IK, that are equal to ED, fhall touch the Curve.

PROPOSITION VII.

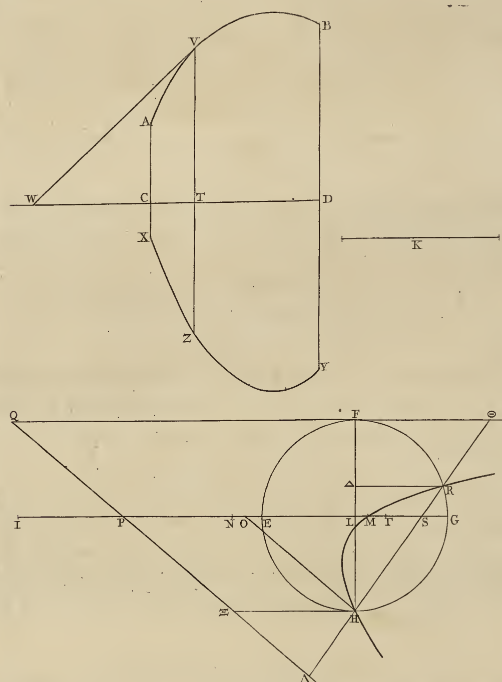
TO draw a Tangent to the Curve defcribed in the preceding Propofition, that the Segment of the Axis intercepted between this Tangent and the Ordinate applied at the Point of Contact fhall be equal to any Line propofed.

Let AB be the Curve, CD its Axis, $EFGH$ the Circle by which it is defcribed, the Diameter of this Circle being EG, and I the Point affumed in that Diameter in order to the Defcription of the Curve AB; and laftly let K be the Line equal to the Segment of the Axis CD that is to be intercepted between the Tangent to be drawn, and the Ordinate applied in the Curve AB at the Point of Contact.

In the Circle $EFGH$ draw the Diameter FLH at Right Angles to EG; take GM a third Proportional to IG and GE; and IG being divided into two equal Parts in N, take likewife MO a third Proportional to NG and K, joining HO; then take OP equal to MO; and draw FQ, QP, the firft of thefe Lines parallel to EG, but the latter parallel to HO. This being done to the Afymptotes QF, QP defcribe through the Point H the Hyperbola HR to meet the Circle $EFGH$ in R, and draw HSR. Then in the Curve AB the Ordinate TV being applied, that fhall be a mean Proportional between IG and MS, and the Tangent VW being drawn, I fay WT, the Segment of the Axis CD intercepted

cepted between this Tangent and the Ordinate VT, ſhall be equal to the Line K.

Let the correſpondent Curve XY be drawn, and the Ordinate VT be produced to Z, and in the Line IG let $N\Gamma$ be taken equal to TZ; then will the Square of VT be equal to the Rectangle under $GE\Gamma$, and VW be to WT as NG to $N\Gamma$. But IG being to GE, or NG to LG, as EG to GM, NG will be to LG as NE to LM. Again, the Square of the Ordinate VT being equal to the Rectangle under $GE\Gamma$, and the ſame Ordinate VT being alſo the mean Proportional between IG and MS, the Rectangle under $GE\Gamma$ is equal to that under



IG, MS, inſomuch that IG will be to GE, or NG to LG, as $E\Gamma$ to MS; and therefore NG being to LG as NE to LM, as NG to LG ſo will $N\Gamma$ be to LS, and by Permutation NG will be to $N\Gamma$, that is the Tangent VW to the Segment WT of the Axis, as LG or HL to LS; or, $R\Delta$ being drawn parallel to EG, as $H\Delta$ to ΔR. But now the *Ratio* of $H\Delta$ to ΔF is duplicate of the *Ratio* of $H\Delta$ to ΔR. Whence as the Square of VW to the Square of WT, ſo is $H\Delta$ to ΔF, and by Diviſion as the Square of VT, that is the Rectangle under IG, MS, to the Square of WT, ſo is twice $L\Delta$ to ΔF, and taking half the Antecedents as the

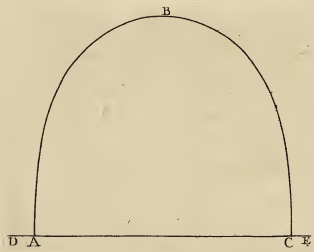
Rectangle

Rectangle under NG, MS to the Square of WT ſo is $L\Delta$ to ΔF. Moreover, produce HR on both Sides to Θ and Λ, and draw $H\Xi$ parallel to EG, then ΘR by reaſon of the Hyperbola will be equal to $H\Lambda$. But as HS to $H\Lambda$ ſo is OS to $H\Xi$, $H\Xi$ being equal to OP or OM; and as HS to $R\Theta$ ſo is HL to $F\Delta$. Therefore as HL or LF to $F\Delta$ ſo is OS to OM, and by Diviſion as $L\Delta$ to $F\Delta$ ſo is MS to OM, and ſo likewiſe is the Rectangle under NG, MS to that under NG, OM, which is equal to the Square of K. But it has been proved, that the Rectangle under NG, MS is to the Square of WT as $L\Delta$ to ΔF; ſo that the Rectangle under NG, MS will be to the Square of WT as the ſame Rectangle under NG, MS to the Square of K. Therefore WT is equal to K.

PROPOSITION VIII.

OF all the Curves deſcribed by the ſixth Propoſition, and continued to their Axes, that Curve, whoſe Tangents in the Points where it meets its Axis, are perpendicular to the ſaid Axis, will by revolving about its Axis, generate a greater Solid than any other Curve whatever adapted to the ſame Axis, and of the ſame Length with this.

LET the Curve ABC be deſcribed to the Axis DE by the ſixth Propoſition, ſo that the Tangents in the Points A, C be perpendicular to DE; I ſay



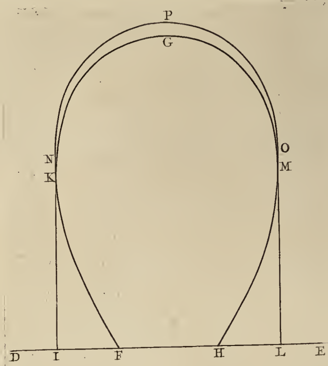
this Curve, by revolving round the Axis AC, ſhall generate a greater Solid than can be generated by any other Curve of the ſame Length with this, and deſcribed through any other two Points in the Axis DE.

IF this be not ſo, ſome other Curve adapted to the Axis DE, will produce the greateſt Solid, that can be formed by Curves of the ſame Length with its ſelf adapted to this Axis.

SUPPOSE therefore FGH to be ſuch a Curve. It is evident that this Curve muſt be one of thoſe, that would be deſcribed by the ſixth Propoſition through the

P Points

Points F, H; for otherwise a Curve might be described through these Points of the same Length with this, which should produce a greater Solid. But it is farther manifest, that the Tangents to this Curve in the Points F, H will make towards the Curve either obtuse or acute Angles with the Axis.



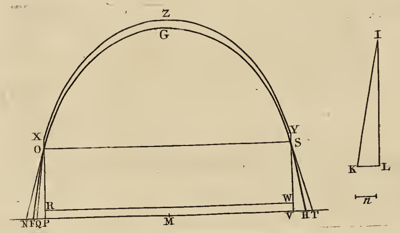
In the first Place, let those Tangents make obtuse Angles: I say another Curve of the same Length with the Curve FGH may be fitted to this Axis, that shall generate a greater Solid than this Curve will generate.

Draw the Ordinates IK and LM, that shall touch the Curve FGH as in K and M; take IN equal to the Arch KF and LO equal to the Arch MH, drawing the Arch NPO similar and equal to the Arch KGM. Then it is evident that the Figure $INPOL$ by revolving about the Axis IL will generate a greater Solid than the Figure $FKGMH$, wholly included within this other, can generate by revolving about the same Axis; but the Perimeter of this Figure $INPOL$ excepting the Base, is equal to the Curve Line FGH; and moreover, a Curve may be described through the Points I, L, of the same Length with the Line $INPOL$, or with FGH, that shall generate a greater Solid than the Figure $INPOL$ will generate. Consequently the Curve FGH will by no means generate the greatest Solid, that can be produced by Curves of the same Length with its self, and adapted to the same Axis.

Again, let the Tangents of the Curve FGH in the Points F, H make with the Axis acute Angles towards the Curve. I say neither will this Curve generate the greatest Solid, that can be generated by any Curve of the same Length with this.

Let the Angle under IKL be equal to that, which the Tangents in F and H make with the Axis. Draw the perpendicular IL, divide FH into two equal Parts

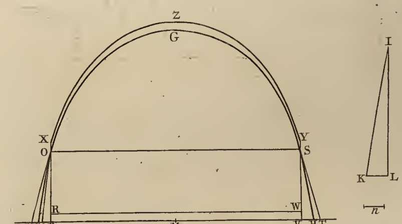
Parts in M, and take the Line n, that the *Ratio* of n to FM may be leſs than the *Ratio* of three times the Square of the Exceſs of IK above IL to the Sum of the Square of this Exceſs and of the Square of IL; then draw the Tangent NO, that OP being let fall perpendicular to FH, NP ſhall be equal to n. By this means the *Ratio* of NP to FM, and more effectually the *Ratio* of NP to NM, will be leſs than the *Ratio* of three times the Square of the Exceſs of IK above IL to the Sum of the Square of this Exceſs and of the Square of IL; alſo by Diviſion the *Ratio* of NP to PM will be leſs than the *Ratio* of three times the Square of the Exceſs of IK above IL to the Square of IL; and likewiſe the *Ratio* of one third of NP to PM leſs than the *Ratio* of the Square of the Exceſs of IK above IL to the Square of IL. Moreover, if OQ be drawn parallel to the Tangent in F, the Triangles OPQ, ILK will be ſimilar; and therefore the *Ratio* of one third of NP to PM leſs than the *Ratio* of the Square of the Exceſs of OQ above OP to the Square of OP. But OQ is leſs than the Arch OF, and therefore the Exceſs of OQ above OP is leſs than the Exceſs of OF above OP. Let PR be taken equal to this latter



Exceſs, and then the *Ratio* of one third of NP to PM being leſs than the *Ratio* of the Square of the Exceſs of OQ above OP to the Square of OP; the ſame *Ratio* of one third of NP to PM ſhall be yet leſs than the *Ratio* of the Square of PR to the Square of OP; and laſtly, one third Part of the Solid, whoſe Baſe is the Square of OP and Altitude NP ſhall be leſs than the Solid, whoſe Baſe is the Square of PR and Altitude MP.

Now draw OS parallel to FH, the Tangent ST, the Perpendicular SV, and laſtly RW likewiſe parallel to FH; then will the Triangles NOP, TSV be ſimilar and equal, and MV equal to MP. Hence the two Cones generated by the Revolution of the Triangles NPO, TVS about the Axes NP, TV will be to the Cylinder generated by the Revolution of the Rectangle $PRWV$ about the Axis PV as one third Part of the Solid, whoſe Baſe is the Square of OP and Altitude PN to the Solid, whoſe Baſe is the Square of PR and Altitude MP. Wherefore the firſt of theſe Solids being leſs than the latter, theſe two Cones are leſs

leſs than the Cylinder; and conſequently the two Solids generated by the Revolution of the Spaces *FPO*, *HVS* about the Axes *FP*, *HV* will be ſtill leſs than the Cylinder produced by the Revolution of the Rectangle *PRWV* about the Axis *PV*. But moreover, if *PX* and *VY* be taken equal to the Arches *FO* and *SH*, ſo that *RX* and *WY* ſhall be equal to *PO* and *VS*; and if the Curve *XZY* be deſcribed ſimilar and equal to the Arch *OGS*; the Space *RXZYW* is ſimilar and equal to the Space *POGSV*. Therefore ſince the Cylinder generated by the Rectangle *PRWV* is greater than the two Solids generated by the Spaces *FPO*, *HVS*, the Solid generated by the Revolution of the Space *PXZYV* about the Axis *PV* ſhall be greater than the Solid generated by the Revolution of the Space *FGH* about the ſame Axis *FH*. But the Perimeter of the Space *PXZYV*, excepting the Baſe *PV*, is equal in Length to the Curve *FGH*, and through the Points *P* and *V* a Curve may be deſcribed of the ſame Length



that ſhall produce a Solid yet greater than the Solid produced by the Space *PXZYV*. Therefore the Solid generated by the Curve *FGH* is by no means the greateſt that can be produced from Curves of the ſame Length with its ſelf applied to the Axis *FG*.

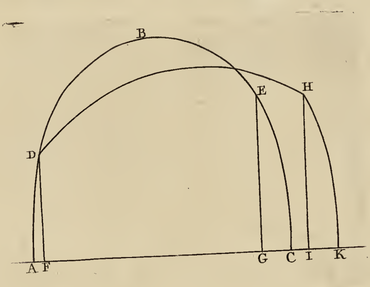
But now ſince the Curve, which generates the greateſt Solid of all, muſt of Neceſſity be one of thoſe deſcribed by the ſixth Propoſition, and it is here ſhewn not to be any of thoſe Curves, whoſe Tangents in the Points, where the Curve meets the Baſe, make oblique Angles with that Baſe, it follows that it muſt be the Curve, wherein thoſe Tangents are perpendicular to the Baſe.

PROPOSITION IX.

IF in the Curve, which generates the greateſt Solid of any of the ſame Length with its ſelf, any two Points be taken, and from them Perpendiculars be let fall upon

upon the Baſe, the Space included by theſe Perpendiculars and the intermediate Part of the Curve ſhall generate a greater Solid than can be produced by a Space included under two Perpendiculars of the ſame Lengths with the former, and under any other Line of the ſame Length with the intermediate Part of the forementioned Curve.

LET *A B C* be the Curve, which in revolving round the Axis *A C*, generates a greater Solid than can be produced in like manner by any other Curve of the

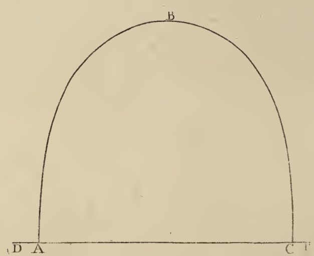


ſame Length with this. If in this Curve any two Points *D*, *E* be taken, and the Perpendiculars *D F*, *E G* be drawn, I ſay the Space *FDBEG* by revolving round the Axis *FG* ſhall generate a greater Solid than any other Space included under two Perpendiculars of the ſame Length with *D F*, *E G*, and under a Line of the ſame Length with *DBE*.

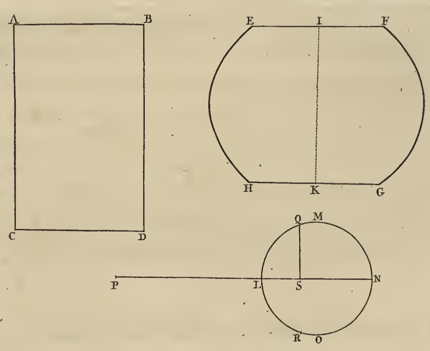
IF not, let the Space *FDHI* generate a greater Solid than the Space *FDEG*, the perpendicular *IH* being equal to *GE*, and the Curve *DH* equal to *DE*. Draw the Arch *HK* ſimilar and equal to the Arch *EC*. Then the Solid generated by the Space *FDHI* being greater than that generated by the Space *FDEG*, the Solid generated by the Space *A D H K* will be greater than that generated by the Space *ADEC*, which is abſurd; for the Curve Line *A D H K* is equal in Length to the Curve *A B C*, and the Curve *A B C* generates a greater Solid than any other Line of the ſame Length. The Space therefore *FDEG* generates a greater Solid than any other Space included under Perpendiculars of the ſame Length with *FD*, *GE*, and under any other Line of the ſame Length with *DE*.

THESE Propoſitions will afford us the neceſſary Aſſiſtance for making the firſt Step of the Inquiry, we have propoſed, concerning the Suppoſition, that the muſcular Fibres are compoſed of Veſicles, by whoſe Inflation thoſe Fibres are contracted. For it will not be difficult now to aſſign in what proportion the Cavity of the Cells

on this Hypothesis must be enlarged, in any degree of Contraction the Fibre shall be supposed to undergo. In the usual way of representing these Cells as small Bladders, whose Sides will wholly collapse together, and leave no Vacuity in the Cells, when the Fibre is entirely relaxed; the Fibre may be contracted by the Inflation of these Cells into less than half its greatest Length: For the first Figure of the eighth Proposition represents the Form into which the Sides of such a Cell will be extended, when the Cell is most inflated, as will be evident by comparing what is there demonstrated, with what has been delivered at the Beginning of this second Part *. And in that Figure the Curve *ABC* bears to its Axis *AC* a



Proportion somewhat greater than that of 35 to 16; this Curve *ABC* being equal to the Length of that Cell, when wholly relaxed, whose Length becomes equal to the Axis *AC*, when the Cell is most of all inflated. But let us now suppose the Cell, when uninflated, to be a Cylinder, whose Section through the Axis shall be the rectangular Parallelogram *ABCD*. The *Ratio* of *AB* the Diameter of the Cell to its Altitude *BD* or *AC* being given, it will be easy to describe the Figure *EFGH*, which shall be similar to the Section through the Axis of this Cell, when



* Pag. xxxv.

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in any degree inflated. Let IK be the Axis of this Figure, or of the Cell, dividing EF and its Equal HG into two equal Parts in I and K. Any Circle $LMNO$ being aſſumed, and in its Diameter produced the Point P, it is only required to take in this Circle the equal Arches QN, RN of ſuch a Magnitude, that IF and KG being made equal to the Chords of the Arches LQ and LR, and the Curve FG being deſcribed from the Circle $LMNO$ after the manner that has been before taught, IF and its Equal KG ſhall bear to FG the ſame *Ratio* as half AB or CD bears to BD or AC: For the Curve EH being deſcribed, ſimilar and equal to FG, the Figure $EFGH$ will be ſimilar to the Section through the Axis of the Cell, when in ſome degree inflated, whoſe Section when relaxed is the Rectangle $ABCD$. But here we muſt obſerve, that when the Point P is ſo taken, that PL is equal to LN, the Figure $EFGH$ is that, which the Cell will receive, when inflated the moſt that is poſſible, and the Proportion of the Side FG to the Axis IK, the greateſt that it can ever become by the Inflation of the Cell, as is evident from the two laſt Propoſitions; and the more PL exceeds LN, the leſs will be the *Ratio* of FG to IK. And this Obſervation ſhews, that the Arches NQ, NR, and the Line LP, may be taken of ſuch Magnitudes, that while in the Figure $EFGH$, the Curve FG or EH ſhall bear the ſame *Ratio* to EF or HG as BD or AC bears to AB or CD, the ſame Curve FG or EH ſhall likewiſe bear any aſſigned Proportion to the Axis IK. As likewiſe by taking LP equal to LN, the Arches NQ, NR may be taken of ſuch a Magnitude, that the Figure $EFGH$ ſhall repreſent the Section through the Axis of a Cell in its greateſt Inflation, while the Side FG or IH bears to the Axis IK any given Proportion leſs than that, which the Curve in the firſt Figure of the eighth Propoſition bears to its Axis. And by this means the Proportion between the Diameter of a Cell and the Length of it may be found, that is required to render the Cell capable of any poſſible Degree of Contraction.

I NEED not be particular in explaining the way of doing all this, ſince it is obvious from Sir *Iſaac Newton*'s Method of Differences.

BUT now, after the Figure of any Cell has been deſcribed, to find the Proportion between the Cavity of ſuch a Cell, when in any degree inflated, to the Cavity of the ſame Cell when relaxed, which it is our principal deſign by theſe Propoſitions to diſcover, it is only required farther to know, that QS being let fall perpendicular upon LN, the Solid, made by the Revolution of the Space $IFGK$ about the Axis IK, is equal to a Cone whoſe Altitude is LN, the Semidiameter of its Baſe, when PL is equal to LN, containing in power the Rectangle under LN and the Curve FG, together with twice the Rectangle under QS and the mean Proportional between PS and LN; but if PL exceeds LN, this Semidiameter contains in power, beſides the forementioned Rectangles, the Rectangle alſo contained under half the Exceſs of PL above LN, and under the difference between the Curve FG and the Axis IK.

BY

By Computation upon theſe Principles it will be found, that if *AB* or the Diameter of the Cell bears to *BD* or its Altitude, when uninflated, the Proportion of about 20 to 37, this Cell in its greateſt Inflation will be contracted into about two thirds of its greateſt Length; and when it is thus inflated, the greateſt Diameter thereof will be to the Diameter of its Baſes, nearly as 100 to 46; and its Cavity will be enlarged in the Proportion of 24 to 10. If the Diameter of the Cell bear to its Altitude, when relaxed, the Proportion of 20 to 23, the Cell is capable by Contraction of loſing one fourth of its Length; and in its moſt contracted ſtate its greateſt Diameter will be to the Diameter of its Baſes nearly as 5 to 3, and its Cavity will be enlarged in the proportion of about $16\frac{3}{7}$ to 10. Likewiſe if the Diameter of a Cell be to its Altitude, when uninflated, as 8 to 5, the Cell can be contracted by its Inflation into four fifths only of its greateſt Length; the Proportion of its greateſt Diameter in that contracted State to the Diameter of its Baſes becoming near the ſame with the *Ratio* of 100 to 69, and its Cavity will be enlarged in the Proportion of 7 to 5.

Moreover it is to be noted, that the Force, with which the Baſes of a Cell are made to approach by its Inflation, very much decreaſes in proportion to the Force wherewith the Cell is inflated, when the Cell approaches its utmoſt Diſtention. For this reaſon it will not be improper to enquire into the Degrees of Enlargement of the Cell in other caſes, beſides theſe now mentioned. Of this kind of Computations take the two following Examples. In the firſt place, ſuppoſe the Cell to be ſo framed, that it ſhall be capable of contracting to half its greateſt Length; for which purpoſe the Diameter of the Cell muſt bear to its Altitude, when relaxed about the Proportion of 1 to $10\frac{6}{13}$. In this caſe, when the Cell is ſo far inflated as to be reduced into three fourths only of its greateſt Length, the greateſt Diameter of the Cell ſhall be ſomewhat more than ſeven times the Diameter of its Baſes, and its Cavity almoſt twenty three times enlarged. Suppoſe again that the Cell by its Inflation can be contracted no farther than into three fourths of its greateſt Length: In this caſe, when it has loſt one eighth of its Length only, the Proportion of its greateſt Diameter to the Diameter of its Baſes will be very little leſs than the *Ratio* of 3 to 2; and the Cavity of the Cell will be enlarged nearly in the Proportion of $15\frac{2}{3}$ to 10.

By ſuch Computations as theſe, when it has been diſcovered in what degree the Cavity of the Fibres of any Muſcle is required on the veſicular Hypotheſis to be enlarged, in order to render thoſe Fibres capable of the Contraction, that ſhall be obſerved to belong to them; the next thing is to conſider how much the whole Muſcle may be required to increaſe in Bulk by the Cavities of its Fibres being thus augmented. And this is the firſt Step towards the Examination of the preſent Hypotheſis; for if the Body of the Muſcle is not found to increaſe in bulk, as much as the Reſult of theſe Computations demands, the Hypotheſis will appear to be abſurd;

otherwiſe

otherwiſe it will merit further conſideration. But in order to make this enquiry into the degree of Intumeſcence to be expected in the Muſcle, ſome conſiderations are neceſſary. In the firſt place it is very obvious, that the whole Muſcle muſt not be expected to enlarge in its bulk, ſo much as the Cavity of its Fibres are required to do; by reaſon that the undiſtended Part of the Muſcle, ſuch as the ſolid Parts of theſe Fibres, and the Fat interſperſed between them, together with the Blood Veſſels and Nerves appertaining to the Muſcle, bear without queſtion no inconſiderable proportion to the bulk of the whole Muſcle. A caution is likewiſe neceſſary in eſtimating the Degree, in which the Fibres of a Muſcle in any Experiment contract; for this muſt not be determined merely from the Contraction of the whole Muſcle, without taking into conſideration the Structure of the Muſcle, and obſerving in what manner the Fibres are ſituated in it. In the third place it ſhould be conſidered, whether the Muſcle experimented upon is contracted to the utmoſt it is capable of, or not; becauſe in this Hypotheſis a greater Intumeſcence is required to contract a Fibre in any given degree, if that Fibre be capable of a yet greater Contraction, than if the given Degree of Contraction be the utmoſt Limit of the Fibre's Action. And we ought farther to add, that the Cells of the muſcular Fibres cannot receive exactly the Figure, which from the preceding Demonſtrations has been attributed to them, unleſs they were diſengaged from each other; whereas by the Reſiſtance, that the Muſcle acts againſt, the Muſcular Fibres are compreſſed together, ſo that the Figure of their Cells will in a good degree be altered by that Compreſſion, and the Action of each Fibre by that means ſo much hindered, that a greater Inflation of its Cavity will be required to produce any deſired Effect, than if the Fibre were at liberty to act to the greateſt advantage. By which means though the Muſcle will not take up ſo much room, as it would do, were its Fibres, when freely inflated, to lie contiguous only to one another, and to leave thoſe intermediate Vacuities, that would be the conſequence of their tumified Figure; yet the Bulk of the Muſcle muſt be greater than the collective Magnitude of its Fibres excluſive of thoſe Intervals.

By how much more the Fibres of the Muſcle, on which trial ſhall be made in this Diſquiſition, are contracted in their Length, by ſo much more viſible and convincing will the Succeſs of the Experiment be. Of all the Muſcles in the Body, the Sphincters ſeem to contract in the moſt eminent degree; but are out of reach from being experimented upon. In compariſon of theſe, the Muſcles of the Limbs, whoſe Action lies better expoſed to Examination, contract but little. Though as they preſerve a good degree of Force, even when contracted to the utmoſt, the Structure of the Joint, they operate upon, will permit; no doubt but they are capable of contracting much more than they do. *Borelli* * indeed undertakes to prove the contrary, that the Muſcles by which the Joints are moved are hardly of themſelves capable of a greater Contraction than what the Form of the Joints do

* De Mot. Animal. part. I. prop. xi. pag. 25, 26.

allow; and that when the Joints, over which Muſcles lie, are fully bent, the Muſcles loſe all their Force. The latter Part of this Aſſertion he would prove from obſerving, that when the Fingers are clinched towards the Palm of the Hand, the Elbow and Wriſt being bent, the Palm cannot be preſſed with any Degree of Force by the Fingers. But this Obſervation will no wiſe confirm what he brings it to prove, ſeeing the Effect here mentioned may as well be attributed to the Muſcles, that are employed in extending the Fingers; which appear to Senſe to be overſtrained, by the Pain that is felt on the Back of the Hand. And the contrary to this Opinion of his is manifeſt in the greateſt number of the Joints. As to his Obſervations in diſſecting living Animals, to which he appeals for proof, that the Muſcles are not of themſelves capable of contracting more than he affirms of them; if theſe Obſervations were accurately made, they are a conſiderable Objection againſt the veſicular Hypotheſis, which of neceſſity requires, that the Muſcles ſhould loſe almoſt all their Force, when they approach near the Limit of their Contraction.

To make an exact Judgment how much more the Muſcles of the Limbs muſt in this Hypotheſis be ſuppoſed capable of contracting, than they do in their ordinary Action, we ought to know the Method of determining, in what Degree the contractile Force of any Veſicle diminiſhes, in proportion as it is more and more contracted: And this may be determined by the help of the ſame two Curves, that we made uſe of in deſcribing the Figures of thoſe Cells. But this I ſhall not farther proſecute, becauſe no ſuch Augmentation of the Muſcle, as is here required, has yet been diſcovered by any Experiment. On the contrary, the Writers upon this Subject have thought themſelves obliged to ſuppoſe little or no Augmentation in the Bulk of the Muſcle. *Steno* * indeed has argued, and with a greater pomp of Argument than ſo plain a matter required, that when the Muſcle is abbreviated in its Length, it muſt increaſe in ſome other Dimenſion, in order to preſerve its Magnitude; the ſame thing being alſo expreſly remarked by *Borelli* †. But *Steno* does not incline to admit that the Muſcles augment in any Dimenſion more than is required for this purpoſe; and ſo much, no doubt, he thought it neceſſary to allow of. Though *Borelli* grants that the Muſcles of the Limbs, when they act, are rather contracted into a narrower ſpace, than when they lie relaxed ‡. But at the ſame time, this laſt Author thinks he has diſcovered, beyond all queſtion, that the Fibres of a Muſcle do increaſe in bulk, when the Muſcle acts. This he would collect from what he imagined he had obſerved of the Heart: But here he was deceived; for he has without ſufficient ground aſſerted, that when the Fibres of that Muſcle contract, and its Cavities are thereby cloſed up, its outer Surface is not diminiſhed ‖. He would conclude the like Intumeſcence in the Fibres of other Muſcles, though the whole Muſcle does not increaſe in bulk, from the conſideration only of their growing rigid upon their acting**. But this Argument is not very convincing, if we

* Myolog. Specim. p. 25. † Borell. de Mot. Animal. part. II. prop. 14. ‡ Ibid. ad fin. prop. 49. ‖ Ibid. prop. 14, & 52. ** Ibid. prop. 14.

except

except only what room may be made for the augmentation of the Fibres by the Compreſſion the Blood-veſſels may be ſuppoſed to undergo; which in many Muſcles muſt be very little, where the Magnitude of the Trunks and conſpicuous Branches of the Blood-veſſels lodged within the Muſcle, out of which only the Blood can be preſſed in quick Motions of the Muſcle, bears a very inconſiderable Proportion to the Bulk of the whole Muſcle. Certainly the Induration of the Muſcle, from whence he would deduce it, does on no other conſideration prove ſo much: For the Softneſs and Flaccidity of the Muſcle, when out of action, does not neceſſarily imply, as *Borelli* ſuppoſes, that the Fibres lie not then ſo cloſe together, as when they are in action; but it is ſufficient for producing this effect, that the Fibres while relaxed eaſily yield to any Force, and give place to any thing, that ſhall preſs upon them, without their making much reſiſtance; whereas when they are in action and tenſe, they muſt reſiſt every Force, that would diſcompoſe the Order, in which they lie by one another. But farther it muſt be conſidered, that the Bulk of the Muſcle ought to be greater, when it acts in a ſtate of great Contraction, than when the Muſcle is more extended, though it be in action. And I doubt no Experiment hitherto made gives any ground to ſuppoſe this. Whence there is great reaſon to ſuſpect, that the ſeeming Intumeſcence of ſome Muſcles, when they act, does only ariſe from a Change made in their Figure.

If this be ſtrictly ſo, it is evident that the Veſicular Hypotheſis muſt be entirely rejected. And even if we ſhould ever, by any future Experiment, diſcover the Muſcles as they are contracted to augment ſomething in Bulk, I fear this Increaſe will be ſo very ſmall, that it will be exceeding difficult to reconcile it to this Veſicular Hypotheſis. Although this Difficulty will be ſomewhat leſſened by our firſt Caution, grounded on the Proportion the contracting Fibres may bear to other acceſſory Parts of the Muſcle. And indeed we have great reaſon to conclude this Proportion to be but moderate, if we conſider how very much the Muſcles are diminiſhed in emaciated Bodies, without the total conſumption of one muſcular Fibre; but only from the loſs of the Fat, which the Microſcope ſhews to be every where diſtributed through the whole Subſtance of the Muſcle.

LET us therefore ſuppoſe, that this Enquiry concerning the Augmentation of the Cavity of the contracting Fibres to remain ſo far doubtful, as to give room for a farther Examination into this Structure of the Fibre. All that *Borelli* * has ſo tediouſly and with ſuch Obſcurity advanced for the exiſtence of theſe Veſicles, is at laſt reduced to that Axiom in Philoſophy, that Nature takes the moſt eaſy courſe in all its Productions. For he has not attempted ſo much to prove his Notions by any Experiments, as to conclude it to be true, becauſe it was the ſimpleſt that he was able to frame in his Mind. But ſuch a Method of arguing is very unworthy a

* De Mot. Animal. Part. I. prop. 113, 114. Part. II. prop. 14.

Philo-

Philoſopher; for though we find indeed by manifold Inſtances, that the Operations of Nature are wonderfully ſimple and uncompounded; yet we are not to imagine, that the Author of the Univerſe, in the formation of things, had any ſuch regard to the Weakneſs of our Capacities, that he ſhould frame his Works in ſuch a manner, as we could moſt readily comprehend; but that he eſtabliſh'd ſuch Principles of Action, as might moſt compendiouſly produce the infinite number of Operations in Nature, though by what means any one of theſe Effects can moſt eaſily be brought about conſiſtent with the reſt, we can in no wiſe pretend to be proper Judges. In the Example before us, though this veſicular Structure of the Fibres may be the moſt obvious Method we are able to think of for their Contraction, yet we cannot be certain, but that the Principle that muſt neceſſarily be required to inflate and diſtend them, might poſſibly be inconſiſtent with every other Operation in the Animal Oeconomy.

They therefore have proceeded with greater Prudence, who have endeavoured to find out ſomething really appearing in the Muſcle, that might favour this Opinion. And the firſt thing that offer'd it ſelf for this purpoſe, are thoſe ſlender Filaments which, in rending the muſcular Fibres aſunder, were found to hold thoſe Fibres together. And certainly if theſe tranſverſe Filaments connected the Fibres together by being twiſted round them, as *Bernoulli* * ſuppoſes, they might be thought to divide the Fibres into Veſicles. But this Diſpoſition of theſe Filaments is not very reconcileable to the anatomical Enquiries that have been made about them. Mr. *Cowper* from particular Obſervations found them unfit for any ſuch purpoſe; for they appeared to him no other than ſmall Veſſels paſſing from one Fibre to another. And this Opinion is farther confirmed by the accurate *Morgagni* †, whoſe Authority is of great weight, as his Diſcoveries in Anatomy have been highly applauded by the Skilful.

Our next Enquiry therefore muſt be, to examine whether this Structure may not be diſcovered in the ſtill more minute Diviſions of the Muſcles. For as the Muſcles are found to be divided by Membranes running through them into ſmall Parts, and thoſe Parts again ſubdivided for ſeveral Succeſſions; each of which diviſions on ſome accounts may not improperly be conſidered as a diſtinct Muſcle; ſo what firſt offers it ſelf to the naked Eye, under the form of a ſingle Fibre, by the Microſcope is found to be a Bundle of Fibres, and as it were a minute Muſcle included within a proper Membrane. Theſe leſſer Fibres are not too ſmall to be diſcerned even by the naked Eye, though not without difficulty. But the Microſcope ſhews us farther, that theſe Fibres are each inveſted with a Membrane, which includes within it not one ſimple Body, but a Bundle of ſtill finer Fibres ‡. Whether theſe are likewiſe compounded of others, has not yet been diſcovered.

* Diſſert. Phyſico-Mech. de Mot. Muſc. Sect. II. pag. 3, 4. Edit. Venet. 1721.

† Adverſar. Anatom. II. Animadv. 7.

‡ Leeuwenhoek. Anatom. & Contempl. pag. 46.

covered. On the contrary *Leeuwenhoek*, who has puſhed his Obſervations on this Subject farther than any other Perſon beſides, thinks theſe laſt mentioned Fibres to be ſimple hollow Tubes *. But his Obſervations cannot be wholly relied upon in ſo ſubtle a Caſe; for if thoſe Pores, he ſees in the tranſverſe Sections of theſe Fibres, are really the Interſtices between different Fibres, and are too ſmall for his Microſcopes to diſcern the Inequalities of them, they will appear of a round Figure, and conſequently as the Hollow of a Tube. Juſt as the Ring of *Saturn*, before Teleſcopes were brought to a ſufficient Perfection, to diſcover the leſs lucid Parts of it, ſeemed to be two round Bodies placed on each ſide of that Planet. In the ſame manner *Leeuwenhoek* himſelf, in this very Subject, was at firſt deceived by the Corrugations, as he afterwards found, into which the Membrane, that inveſts the ſmall Bundles of Fibres before mentioned, forms it ſelf; for ſeeing theſe Corrugations indiſtinctly through leſs perfect Glaſſes, he concluded the Fibres to be a String of globular Parts †. But his more exact Obſervations have not diſcovered the leaſt Traces of ſuch an Appearance.

THE only Circumſtance in all *Leeuwenhoek*'s Obſervations, that any way favours the Hypotheſis we are here conſidering, are thoſe Corrugations he relates the Membrane, that invelopes the Fibres, to fall into; which, from the oblique Situation he finds them generally to take, he believes to ſurround the Fibres in a ſpiral manner ‡. And indeed were any Subſtance, firmer than the reſt of the Membrane, obſerved in theſe Corrugations, it were all that could be wiſhed for in favour of the Hypotheſis. If it were ſo, theſe Bundles of Fibres might contract themſelves by the Intumeſcence of the Parts between theſe Corrugations; and the Figure, into which the Sides of theſe Bundles of Fibres would ſwell, muſt be the ſame as if the Conſtrictions were directly tranſverſe, as will eaſily be underſtood from what *Torricelli* ‖ has writ on the Meaſurement of the Screw. But no ſuch firm Subſtance has yet been found in theſe Corrugations, nor is there any reaſon to ſuppoſe there lies hid in them any ſuch; ſince the Corrugations in theſe Membranes have nothing in them peculiar; but the ſame, without any viſible difference, are ſeen in the Fibres of the Tendons **.

SINCE therefore we cannot make any immediate Diſcovery of this Structure of the Fibres, we ſhall even be reduced to the Weakneſs of *Borelli*'s Argument for their Exiſtence, unleſs we can corroborate his Reaſon by one of theſe two Methods; either that we could diſcover ſomething exiſting in the Body, that we might know to be capable of inflating theſe Veſicles, were there any ſuch; or in default of this, that at leaſt we ſhould be able to frame in our Minds a Notion of ſome Principle ſuited to produce the Effect required, which we could plainly ſee, would give no impedi-

* Philoſoph. Tranſact. N°. 367. pag. 139, 140. † Anatom. & Contempl. pag 43. ‡ Epiſt. Phyſiol. Delph. Ann. 1719. epiſt. 16, 33. ‖ Oper. Geom. de Cochleâ, pag. 136, &c. Tract. de Dimenſ. Parab. ** Epiſt. Phyſiol. epiſt. 16, 33.

ment to the other Operations in the animal Oeconomy. For without one of theſe, in acquieſcing in this Hypotheſis, we ſhall do no better than that Perſon, who being only acquainted with the apparent Motion of the Sun, ſhould immediately conclude the Earth to be in the Center of the World, becauſe he could explain what he had obſerved without difficulty, by ſuppoſing the Sun to revolve round the Earth; and ſhould not hold his Mind in ſuſpence, till he had examined the Motions of the other Planets, and conſidered how well his Opinion could be reconciled to the whole Syſtem. As ſuch a Perſon would act altogether raſhly, in imagining the State of things muſt needs be agreeable to the firſt Notions of his Mind, and what would appear to him moſt reaſonable, before he had fully inquired into the Conſtitution of the Univerſe; ſo neither ought we to take up an Opinion concerning the Frame of theſe Fibres, without being able either to ſee, that they are ſo framed, or yet to have ſufficient reaſon to know, that muſcular Motion could conveniently be produced by ſuch a Structure. For what convinces us, that our firſt Thoughts of the Motion of the Sun is erroneous, and that the Earth it ſelf really moves, is, that this latter Suppoſition we cannot only explain with eaſe the Appearances that belong to the Sun only, but account with the greateſt exactneſs for every Appearance in the whole Syſtem. But the Writers on the preſent Subject have not examined the matter with this exactneſs; as will appear from the Enquiry we ſhall now proceed to make into ſome of the principal Opinions they have advanced.

But firſt it is proper to premiſe, that the Nerve is one chief Inſtrument, which puts the Muſcle into action, as is evident from hence, that whenever the Nerve belonging to a Muſcle is ſeparated from it, it is no longer in the power of the Animal to put the Muſcle into action. This Office of the Nerve is generally allowed to be performed by the means of ſome very fine and ſubtle Fluid, which is called by Authors the Animal Spirits; and that the Contraction of the Muſcles concerned in voluntary Motion ariſes from this Spirit being ſome way operated upon at the Original of the Nerves. All which ſeems evident from this Obſervation, that a Ligature upon the Nerve deprives the Muſcle of its Motion as effectually, as if the Nerve were divided.

Pyerus * indeed has obſerved of the Heart, a Muſcle whoſe Motion is involuntary, that in ſome Creatures, as particularly in the Eel and Salmon, by being warmed it would long after the Death of the Animal renew its Pulſation; nay even when ſeparated from the Body. And the ſame curious Perſon renewed the Pulſation of the Heart in other Animals alſo, after their Death, by inflating it through the Receptacle of the Chyle; eſpecially if an external Warmth was likewiſe applied. But theſe Experiments are no Objection againſt the Office aſſigned to the Nerves in reſpect of the Muſcles concerned in voluntary Motion; for they are conſiſtent with the ſame Uſe of the Nerves in the Heart it ſelf, ſeeing it may

* Miracul. Anatom. pag. 107, &c. in Parergis.

very

very well be ſuppoſed, that the Nerves lodged within the Subſtance of the Heart may retain a ſufficient ſtock of this ſubtile Spirit, by which the Muſcles are actuated, to produce ſome degree of Pulſation, when this Spirit ſhall be put into action, by warming and agitating the Heart; ſince theſe Experiments ſucceeded beſt in Animals that had died a violent Death, and had not their Spirits exhauſted by a long Diſeaſe, and a gradual Decay of Life. Nay, as theſe Experiments do not oppoſe this Office of the animal Spirits, ſo we may receive much light from them, not only in relation to the Heart in particular, but concerning the Muſcles in general. Of the Heart they ſeem to inform us, that its ſucceſſive Contractions and Relaxations do not ariſe ſo much from any alternate Change wrought at the original of the Nerves, in the manner that the Muſcles, ſerving for voluntary Motion, are put into action, or cauſed to reſt; but more from the very Structure of the Heart it ſelf, whereby in its contracted ſtate the Paſſage of the Spirits into its Fibres may be intercepted. For then, without any change wrought in the Spirits at a diſtance from the Heart, its Fibres cannot remain long contracted; and on the other hand, will be no ſooner relaxed, than a Paſſage being opened for the Spirits into the Fibres, their Contraction will again be renewed. But theſe Experiments will much aſſiſt us likewiſe in making a right Judgment concerning the uſe of the Blood in muſcular Motion: For the Blood appears ſome way neceſſary thereto; ſince it has been found, that by intercepting the Paſſage of the Blood to any Muſcle, the Muſcle loſes its moving Power. But from theſe Experiments it may well be queſtioned, whether this effect ariſes from any other Cauſe, than that by depriving the Muſcle of its Blood, the Fibres and Nerves muſt ſoon grow cold and ſtiff: For we ſee in theſe Experiments, that the Fibres of the Heart, when warm, contracted themſelves, though the Blood was not circulating through them. And this Suſpicion, that the Blood aſſiſts in muſcular Motion only by preſerving the Parts in a proper ſtate for the Spirits to paſs through the Extremities of the Nerves, and perform their Office on the muſcular Fibres, is farther confirmed from Experiments of Mr. *Cowper*, who by injecting warm Water only into the Artery of Muſcles concerned in voluntary Motion, after the Paſſage of the Blood had been intercepted, cauſed them to renew their Contraction.

But the Authors of the Hypotheſis, we intend here to examine, aſcribe a more particular Uſe to the Blood; for they ſuppoſe the Fluid in the Nerves to inflate the Cells of the muſcular Fibres by rarifying the Blood within them. Without queſtion there are certain Juices intimately diſtributed throughout theſe Fibres. Mr. *Cowper* relates, that he found them very plentifully charged with Mercury he had injected into the Artery. For the explaining of this ſuppoſed Operation, our Countryman Dr. *Croon* *, and *Borelli* †, proceed no farther than to aſcribe it to a Fermentation ariſing from the mixture of the Animal Spirits with theſe Juices. But as this general Expreſſion gives us no real light into the Subject, ſo the

* De ratione Mot. Muſcul. † De Mot. Animal. Part. II. prop. 26, 27.

Effects

Effects of this ſuppoſed Fermentation ſhew it muſt be of a very ſingular kind, and very different from what generally goes under that Name. That on ſome occaſions this imagined Fermentation ſhould ſo ſuddenly be blown up into a great Effervéſcence, and again ſo immediately ſubſide, as is required not only for the quickeſt Motions in larger Animals, but ſtill more ſurprizingly in the ſmall Inſects, many of whoſe Motions are ſo prodigious ſwift, as often to eſcape the Sight: That on other occaſions the ſame Fermentation ſhould be conducted with ſuch exceeding ſlowneſs and regularity, not only in the principal Muſcles in action, but in thoſe others, which in almoſt every Motion of the Body act in ſubſerviency to the principal ones, by preſerving themſelves in a ſtate of tenſion, relaxing or contracting by the minuteſt differences, with infinite variety ‡; that we ſee the Limbs not only capable of moving with great exactneſs in the ſloweſt manner, that the naked Eye can diſcern, but even that Objects ſhall be carried over the Eye by our Hand with no ſmall degree of ſlowneſs, when ſeen through large magnifying Glaſſes. No wonder then that, in order to account for theſe ſurprizing *Phænomena*, it has been much deſired to find out ſome particular way, by which this ſo unuſal a kind of Fermentation might be explained. For this two Hypotheſes have been framed, one by the celebrated *John Bernoulli* ||, the other by Dr. *James Keil* **; but both inſufficient. They both aſſume the red Globules of the Blood to be ſmall Bladders filled with Air, or ſome other elaſtick matter, in a ſtate of greater compreſſion, than the Air is in, which ſurrounds the Body. The tenacity of the Coats of theſe Globules is ſuppoſed to retain the elaſtick Subſtance within them ſo compreſſed; and the taking off that reſtraint in the Globules, as they paſs through the Cells of the Muſcles, and thereby permitting the elaſtic Subſtance to expand it ſelf, and inflate the Cells, is aſſigned for the cauſe of the Contraction of the Muſcles. Thus far the two Hypotheſes agree; but they differ in the manner of ſetting the elaſtic Subſtance at liberty to expand it ſelf. *Bernoulli* aſcribes to the Animal Spirits a pungent and penetrating Quality, by which they might be enabled to perforate the Coats of the Globules, and thereby let out the impriſoned *Aura*. Dr. *Keil* ſuppoſes this effect may be produced by the Principle of Attraction, that has been diſcovered by innumerable Experiments to belong to the ſmall parts of matter ††. Upon this Principle it is only required, that the Nerves be ſo diſpoſed in the Muſcles, as to open by numerous Orifices into each Cell, and on every ſide of it. And when the Spirits are moved toward the Muſcle, and are entering into the Cells at thoſe Orifices, as ſoon as the Particles of them come within a certain diſtance of the Globules, the Coats of the Globules, and thoſe Particles muſt be ſuppoſed to attract each other. By this Attraction the Particles of the Spirits will have their Motion towards the Globules accelerated; and theſe Particles, like all corporeal Subſtances, having a *vis inertiæ* in proportion to the quantity of matter in them, they will reſiſt in ſome degree to this augmentation of their Motion; and ſo much will the Particles,

‡ *See* Memoir. de l'Acad. Royale de Sciences, Ann. 1720. pag. 87, 88. || Differt. de Mot. Muſcul. §. 5.
** Tentam. Medico-Phyſic. pag. 135, 136. †† Newton. Opt. Qu. 31.

which

which compoſe the Coats of the Globules, be ſolicited towards the Particles of the Spirits, and thereby have the force of their Coheſion with each other diminiſhed, giving liberty to the included elaſtic Fluid to dilate and expand it ſelf. But in this Hypotheſis the Globules will expand themſelves with no greater force than what could generate in any given ſpace of time that Degree of Motion, which will be communicated by this Attraction to the Particles of the Spirits in the ſame time; and therefore, conſidering how very minute the Particles of theſe Spirits are, this Attraction, to produce any conſiderable effects, ought to be exceeding ſtrong, and the increaſe of Velocity given to the Spirits muſt be immenſly great. However, this Hypotheſis is better reconcileable than the former to the Quickneſs, with which the Muſcles contract and relax: For the Particles of the Spirits unite with the Globules of Blood in ſo very ſhort a ſpace of time after their acting upon them, that as ſoon as a freſh ſupply of Spirits is diſcontinued, the Dilatation of the Globules will almoſt inſtantaneouſly ceaſe. But *Bernoulli*, in his Hypotheſis, in order to account for this ſudden Detumeſcence of the Muſcle, is obliged to repreſent the elaſtic matter contained in the Globules ſo very fine and ſubtle, and diſpoſed to paſs through the Pores of the muſcular Cells with ſo much freedom, as makes it very difficult to conceive, how it ſhould be confined by the tender Coats of the Globules.

But yet both theſe Hypotheſes, as I have ſaid before, muſt be looked upon as inſufficient, becauſe the red Globules of Blood, in all probability, are not Veſicles filled with any ſuch elaſtic Subſtance, as is ſuppoſed in theſe Hypotheſes; but, on the contrary, nothing more than a Fluid, or at leaſt a Subſtance preſerved in a State of Fluidity by the Heat and Motion of it, which will not perfectly mix and unite with the *Serum*; and therefore ſwims in it under the form of ſmall Globules, for no other reaſon than Oyl does in Water, when they are agitated together. Which ſingle Obſervation is ſufficient to ſhew, that neither of theſe Opinions have that degree of probability, that is neceſſary to entitle them to a reception. Nay, if the make of theſe Globules was more doubtful than it really is, yet as theſe Opinions are no other than mere Hypotheſes, we could have no ſtrong perſuaſion of their truth: eſpecially ſince theſe are not the only Conjectures, that might be framed concerning this matter. For might it be allowed to build an Hypotheſis on any of the Thoughts of that great Philoſopher, whoſe chief Glory conſiſts in having baniſhed all Uncertainties from his Inquiries into Nature, and in raiſing natural Knowledge upon a more ſolid and durable Foundation, we might ſet the effects of the Animal Spirits upon the Juices, that may be contained in theſe ſuppoſed Cells, in a light yet more familiar, by what Sir *Iſaac Newton* * has hinted concerning muſcular Motion. For we need not have recourſe to any imaginary Elaſticity in a Fluid, flowing in the Fibres, if we aſſume with him, that the Fluid contained in the Nerves is probably no other than part of that ſubtle, rare, and elaſtic Spirit, he concludes to be diffuſed through the Univerſe, as the moſt likely

* Newt. Opt. Qu. 24.

t Cauſe

Cauſe of the Reflection, Refraction and Inflection of Light, and of that extraordinary and ſuprizing *Phænomenon* of Light firſt diſcovered by him; of its being ſubject to regular fits of Reflection and Tranſmiſſion alternately ſucceeding each other in its Paſſage through Bodies *. The ſame Spirit he ſuppoſes to communicate Heat to Bodies †, and to produce all thoſe Appearances, in which the ſmall Particles of Matter ſeem to attract and repel each other ‡. Allowing, I ſay, the Fluid of the Nerves to be a Part of this Spirit, the Intumeſcence of the Juices in the Cells of the muſcular Fibres may in ſome degree be illuſtrated by a very familiar Operation in Nature, the forementioned Expanſion of Bodies by Heat: For if we aſcribe this Expanſion to the vibratory Motion of the ſubtle Spirit within the Body, there will nothing more be required for the preſent purpoſe, than to ſay, that the Mind, when it wills a Part to be moved, acts upon this Spirit at the Extremity, to which it is preſent, of the Nerve, ſo as to communicate a proper Pulſation and vibratory Motion of this Spirit through the whole Nerve, ſuppoſed of ſo uniform a Subſtance, that the excited Pulſes may be propagated through it without Interruption, till they arrive at the Cells of the muſcular Fibres, where they may cauſe ſuch an Agitation in this ſame elaſtic Spirit within the Juices, wherewith the Cells are filled, as may rarify and dilate thoſe Juices. Certainly the moſt ſuddain Relaxation of the Muſcles is eaſily accounted for by this way of explaining their Motion: For as ſoon as ever the Mind ceaſes to act upon that Part of the elaſtic Spirit, to which it is preſent, the Pulſes propagated from thence will immediately be diſcontinued; and conſequently the muſcular Fluid, whoſe Expanſion is occaſioned by thoſe Pulſes, will forthwith ſubſide; juſt as the Pulſation of the Air, which is the Cauſe of Sound, preſently ſtops, and the Sound depending upon it periſhes, as ſoon as ever the ſonorous Body ceaſes to vibrate. Though, as in the Air the different Degrees of Quickneſs in its Pulſations, by which the ſeveral Species of muſical Notes are formed, are not the only Varieties in the Air's vibratory Motion, ſo by the Licence ſo neceſſary to the Framers of Hypotheſes, we muſt here conceive ſome difference between this vibratory Motion, whereby the Fluids in the Muſcles are to be expanded, and that which occaſions Heat in Bodies; becauſe we do not find the Muſcles to grow conſiderably hot in their Action.

But to leave ſuch Gueſſes, as the Experiments we have mentioned of *Pyerus* and Mr. *Cowper* ſhew, that the Effects obſerved from intercepting the Paſſage of the Blood through the Artery to any Muſcle are no direct Proof, that the Blood conſpires any farther to muſcular Motion, than by preſerving the Parts of the Muſcle in a due Temper; ſo by what has now been ſaid, it appears, that we have yet no other convincing Reaſon to conclude, that the Blood, or other Juices lodged within the Fibres, have any more particular Uſe therein; as no real Diſcovery has yet been made of any ſuch Uſe of theſe Juices. Nay moreover, ſince we can neither form any diſtinct

* Newton's Opt. Qu. 18. † Ibid. ‡ Philoſoph. Nat. Princ. pag. ult.

Notion

Notion of the way the Veſicles of the Fibres ſhould be inflated, nor yet have any direct Proof of the Exiſtence of ſuch Cells; it will at length follow, that the Hypotheſis it ſelf can lay claim to no greater Degree of Certainty than any other of thoſe Conjectures, with which *Des Cartes* and his Followers, in contemplating ſo great a Subject as Nature, have idly amuſed themſelves.

But their Method of Philoſophy ought entirely to be laid aſide: For as the Event has abundantly ſhewn, that no Improvement in the Knowledge of Nature can thence be expected; ſo it was the higheſt Vanity to enter at firſt upon ſuch a Scheme, ſeeing to hope any Succeſs therefrom, was to imagine our weak Underſtandings by a ſlight Act of Fancy able to penetrate the Deſigns of the wiſe Author of all things, of whom it is declared, that his Ways and Thoughts are as far above our Conceptions, as the infinite Extent of the Heavens is remote from this Earth, to which we are confined. We ought not indeed to be eaſily diſcouraged from making Inquiries into the Cauſes of things: For as the Experience of all Ages proves nothing to be more agreeable to contemplative Minds, ſo nothing ſeems more worthy of our Thoughts, as the Conſideration of the Frame of Nature eminently ſets forth not only the Power, but the Wiſdom likewiſe of its Author: And therefore nothing can be more ſuited to enlarge the human Underſtanding, and improve the nobleſt Faculty of our Minds, and at the ſame time to promote the Knowledge of our Creator, wherein conſiſts our chief Happineſs. But the more excellent the Knowledge of Nature is in it ſelf, by ſo much the more are to be condemned the Proceedings of theſe miſtaken Philoſophers. For while the utmoſt Diligence and Modeſty in ſearching into the Works of Nature by the ſloweſt degrees are of neceſſity required to enable our limited Capacities to trace out any of the hidden Cauſes of things, we cannot ſufficiently admire, that Men of warm Imaginations ſhould build up at once vain Syſtems upon raſh Determinations of what thoſe Cauſes are, from ungrounded and precipitate Conjectures. Not as if our utmoſt Abilities were too ſmall ever fully to diſcover the Wiſdom neceſſary to compoſe this Order and Diſpoſition of things, the Authors of this conjectural Philoſophy proceed as if they imagined theſe Effects of infinite Wiſdom a Contrivance almoſt within the reach of human Invention: For however abſurd it would be in any one expreſly to boaſt himſelf endued with Sagacity ſufficient to contrive this ſtupendious Frame of Nature in all its Beauty and Perfections; yet *Des Cartes*, to gain an imaginary Empire in Philoſophy, has boldly adventured upon a way, that can be allowed rational only in a Being who thought himſelf inferior to the ſupreme Author of all things chiefly in Power.

Surely nothing but the ſeeming Impoſſibility of advancing any great length in natural Diſcoveries by a more regular Method, could prevail on any ſober Inquirers into Truth to follow *Des Cartes* in ſo prepoſterous a Courſe. And indeed we could not much have wondered, if the exceeding ſmall Advancement made in Philoſophy by

by thoſe very few, who through the Courſe of all the learned Ages, at great Intervals of Time, have diſtinguiſhed themſelves by purſuing their Searches into Nature upon true Principles, had occaſioned Philoſophers wholly to deſpair of arriving at any Certainty in the more recluſe Parts of Phyſics. For now our great Philoſopher has at length in ſo ſurprizing a manner enter'd into the Depths of Nature, we find much leſs reaſon to admire, that his Diſcoveries had lain ſo long concealed, than that they ſhould ever have been ſearched out. Diſcoveries that have given a proof of the moſt flowing and abounding Invention, of the profoundeſt Penetration, and of the ſublimeſt Force of Reaſon: Not only where it was neceſſary to apply the ſubtleſt Parts of Geometry, and even to improve that Science much beyond its former Bounds; as where he has diſcloſed the Nature and Operations of Fluids, and diſcovered the great Principle, that keeps in motion the large Bodies of the Univerſe; but if poſſible, yet more in thoſe Advancements he has made from the conſideration of Light into a more hidden part of Nature, by the moſt refined and powerful Reaſonings upon the moſt obvious Obſervations, even to the deducing many wonderful Secrets of Nature from things, which appeared wholly barren not only to common Capacities, but to the Philoſophers of the greateſt Penetration.

Even fully to perceive the Progreſs this excellent Perſon has made in the real Knowledge of Nature, calls for the utmoſt Application and Thought; inſomuch that many, who would have formerly paſſed for no mean Philoſophers, have ingenuouſly owned themſelves unable to comprehend ſome of Sir *Iſaac Newton*'s moſt ſublime Speculations. But however difficult the ſearching into Nature may appear, doubtleſs when this true Method of Philoſophy comes to be generally underſtood, it will entirely put a ſtop to the falſe way, that has prevailed in the World. When we ſee thoſe Principles of natural Operations, that are now diſcovered, are ſo widely diſtant from our moſt refined Conjectures concerning them, it will be impoſſible for us for the future to receive any kind of Hypotheſis with the leaſt approbation. If in one of the moſt ſimple Productions of Nature, the Motions of the heavenly Bodies, the Principle by which they are preſerved, is ſo much above the reach of our Conceptions, that we hardly find any one, that can reconcile it to his Thoughts, who does not ſee the full Force of the Demonſtrations, by which it is proved; how can we conceive the briſkeſt Imagination ever able to diſcover any of the more concealed Springs of natural Effects? Theſe Conſiderations ſurely will intirely free us from that Miſtake the Philoſophers ſeem to have laboured under, who imagined it was required of them to account for almoſt all the Appearances of Nature; inſomuch that we find the very manner how a World or an Animal might be formed, is frequently attempted by the Framers of Hypotheſes, who yet were ſo far from being qualified for ſo daring an Enterprize, that on the contrary they have ſhewn themſelves not really able to diſcover the obvious Laws of Motion. But we ought to be more modeſt in our Inquiries, and not go ſo precipitantly to work. If we can truly diſcover any one ſtep, Nature takes in her Productions, we ought to look upon it as a conſiderable Attainment, without repining at our not being able to trace her

through

through all her Cauſes. The leaſt acquaintance with the true Philoſophy will ſerve to ſhew us, that the Queſtions generally diſputed in the common Syſtems are ſo far from being determined, that if we ſhall ever be able to come at their knowledge, it muſt be through a Courſe of many Ages employed in the true Method.

Let therefore the conjectural Philoſophy, which has hitherto hindered the Progreſs, that might have been made in the Knowledge of Nature, be for ever baniſhed. And now a true way is fully brought to light, let every Inquirer after Truth without delay enter upon it. The way indeed is rough, and beſet with difficulties, but not unpaſſable, nor yet unpleaſant, if we free our Thoughts from the airy Conceits and exorbitant Expectations, which uſed to ſwell the Minds of Philoſophers, and make it painful for them to acquieſce in the ſmall Meaſure of Science within their power. A Mind thus inflated by graſping at the Knowledge of all things, can underſtand nothing truly; but to one prepared with the juſt Love of Truth, the Diſcovery of our Ignorance in any particular will be more grateful than any tranſient Fame, that may attend a falſe Pretenſion to Knowledge. For this reaſon I have choſe in this latter part of the preſent Diſcourſe only to ſet out, in the plaineſt manner I was able, how inſufficient all Conjectures have hitherto been at the Cauſe of muſcular Motion, without hazarding to augment the Number of Errors by recommending any new Conceit of my own.

If I am not miſtaken, we muſt have made a much greater Progreſs in the Knowledge of Nature, before any Light can be got in ſo recluſe a Subject with the leaſt degree of Certainty. While we are wholly Strangers to the Principle, that cauſes the Parts of Matter to adhere together, and how it comes to paſs, that this Principle ſhould operate with ſo much Strength, while the Parts of the ſolid Body are yet kept from the moſt intimate Contact they are capable of; how a Body ſhould be increaſed in all its Dimenſions by Heat, and yet retain in great meaſure its Solidity; how can we know, but there is ſome Power in Animals, that can operate upon this Principle, which keeps the Parts of their Fibres together, and can ſtrengthen the Effects thereof upon proper Occaſions, ſo that the Particles of thoſe Fibres ſhall be made to approach each other with great force? And if the Cauſe of muſcular Motion ſhould lie ſo remote as this Principle, which I ſee no Abſurdity in ſuppoſing, it is impoſſible for us in the preſent Infancy of natural Philoſophy to diſcover any thing concerning it.

ERRATA.

Pag. lxvii. l. 31. del. *that*. Ibid. l. antepenult. l. *Notion*. Paſſim pro *Gaſterocnemius* leg. *Gaſtrocnemius*.

MYOTOMIA REFORMATA:

OR, A

New Administration and Description

OF THE

MUSCLES

OF A

HUMAN BODY.

CHAP. I.

Of the MUSCLES *of the* ABDOMEN.

IT being usual for the Contents of the lower Belly to putrefy and grow offensive sooner than any other Part of the Body, Anatomists for this Reason generally begin their Dissections with the ABDOMEN. This is done by making a crucial Incision through the common Integuments, one Line of which is continued from the *Cartilago Ensiformis* directly to the *Os Pubis*; the other is drawn transversly from the Navel to the Region of the Loins on each side; after which the Skin, Fat, and Membranes of each Portion being raised from their respective Angles, the Muscles

of the ABDOMEN present themselves to View. In the particular Enumeration and Description of these, as well as of all the other Muscles of the Body, we shall constantly observe that Order, in which they will most readily appear in Dissection.

I.

Tab. I. XIV.

OBLIQUUS DESCENDENS,

ARISES partly tendinous, but chiefly fleshy from the lower Margins of the fifth, sixth, seventh, and eighth Ribs, where its several separate Originations lie between the Indentations of the *Serratus Major Anticus*; these, for better Distinction, we chuse to call its first Origin. Besides which, it continues to derive more Heads in like manner from the ninth, tenth, eleventh, and sometimes from the Extremity of the last Rib; which Heads we shall call its second Origin. From the former Origin, its fleshy Part, descending obliquely, expands itself into a broad membranous Tendon, before it marches over the *Rectus* to its Insertion into the *Linea Alba* and *Os Pubis*. From the latter Origin, descending in the same manner, it ends tendinous in the *Os Pubis*, and partly tendinous, but chiefly fleshy, on the upper and forepart of the circular Edge of the *Os Ilium*, without any Adhesion to the *Vertebræ* of the Loins, as *Spigelius* *, *Veslingius* †, and with them most other Anatomists, have imagin'd. As its last, thickest, largest, and most fleshy Digitation descends obliquely forward from the lowest Bastard Rib, and recedes more and more from the *Vertebræ* of the Loins, it forms a triangular Interstice, comprehended by its own lower Side, the *Sacrolumbalis*, and part of the Spine of the *Os Ilium*, in which *Area* the Fibres of the subjacent ascending Muscle plainly appear, after raising part of the *Latissimus Dorsi*, and clearing away the Fat.

Tab. XIV. C. *Tab.* XV. L. L. THE lower tendinous Margin of this Muscle, which lies between the Spine of the *Os Ilium* and the *Os Pubis*, is particularly contriv'd to secure the Contents of the lower Belly from being extruded there, in the same manner as it frequently happens at the Perforations for the Passage of the spermatick Vessels. Notwithstanding which, it is not impossible, but that Ruptures may sometimes happen in this Part; and I am apt to imagine this to be the case when a Rupture is very large, and not to be retained by a Truss.

BESIDES the Actions commonly ascribed to this Muscle and its Partner, together with the other Muscles of the *Abdomen*, of assisting in Exspiration, of compressing the Intestines, Bladder, and *Uterus*, and thereby excluding the *Fæces* and Urine in both Sexes, and the *Fœtus* in Women; they seem to have a farther use in assisting to bend the Body forward: And that Part of them which lies between their latter Origin and the Spine of the *Os Ilium*, may serve for the Circumrotation of the Trunk upon the *Axis* of the *Vertebræ*, when we turn the Body toward the contrary side, the Feet remaining unmoved.

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* *Hum. Corp. Fabr. Lib.* IV. *Cap.* X. † *Syntagm. Anatom. Cap.* II.

FOR

For *the better Diſſection of the Muſcles of the* Abdomen, *it may be convenient to obſerve the following Method. Firſt of all raiſe that Part of the* Latiſſimus Dorſi, *which lies on the* Obliquus Descendens. *This being done, the Blood ſpong'd up and the Fat clear'd, begin the Separation of the Oblique deſcending Muſcle, by thruſting your Finger between it and the* Obliquus Aſcendens, *at the Extremity of the loweſt Baſtard Rib: Then raiſe that Part of the* Descendens *which ſprings from the loweſt Rib, and terminates in the Spine of the* Os Ilium. *After which proceed to free the reſt of its Digitations from the* Serratus Major Anticus, *being cautious not to wound its Tendon in dividing it from the ſubjacent Muſcle, eſpecially where it marches over the* Rectus. *Nor may the Separation of the Tendons of the oblique deſcending and aſcending Muſcles be attempted, unleſs in an Hydropical Subject, by reaſon of their ſtrict Adheſion to each other. Wherefore in preparing theſe Muſcles, when they are to be ſhewn after Diſſection, you may proceed in the following manner.*

The Obliquus Descendens *being raiſed on either ſide (as before) to the* Rectus, *cut through the Tendon of the* Aſcendens, *and raiſe both Tendons together, taking ſufficient Care in their Separation from the Interſections of the* Rectus, *to which they firmly adhere, and leave them at their Inſertion in the* Linea Alba. *This done, on the contrary ſide raiſe the fleſhy Part only of the* Descendens, *beginning in the* Linea Semilunaris, *by making an Aperture in its Tendon, towards the lower Part of the* Linea Semilunaris, *where it is ſeparable from the* Aſcendens: *Then thruſting in a Probe between the two Tendons, divide that of the* Descendens *the length of the* Abdomen; *after which raiſe the fleſhy Part of the* Descendens *on this ſide, clear it to the Extremities of its Digitations, and leave it there. Having thus raiſed the deſcending Muſcles, that on one ſide being left at its tendinous Inſertion in the* Linea Alba, *and the other being cleared to its Origination, proceed next to raiſe the ſubjacent aſcending Muſcles, and on that ſide, where you have before rais'd the* Descendens *to its Inſertion, raiſe the* Aſcendens, *and leave it at its Origination: On the oppoſite ſide raiſe the* Aſcendens *from its Origination, and leave it ati ts Inſertion in the* Linea Alba, *continued with part of the Tendon of the* Descendens, *to which it is inſeparably join'd in paſſing over the* Rectus, *as above noted.*

N. B. *You muſt be cautious in raiſing the* Obliquus Aſcendens *towards its Origination, leaſt the* Tranſverſalis *ariſe with it; which may be avoided if you begin its Separation in the* Ilium, *by thruſting your Fingers between the* Aſcendens *and* Tranſverſalis.

II.

Obliquus Ascendens. *Tab.* II. XV.

THIS Muſcle ariſes tendinous from the hinder Part, and fleſhy from the fore Part of the Spine of the *Os Ilium*, and the *Ligamentum Pubis*, and thence mounting with an Order of Fibres inclining forwards, is inſerted fleſhy into the eleventh and twelfth Ribs, and afterwards forms a broad thin membranous Tendon, implanted into the whole length of the *Linea Alba*, and the Cartilages of the eighth, ninth, tenth, eleventh, and twelfth Ribs.

Besides

BESIDES its uſe in compreſſing the Contents of the *Abdomen,* that part of it which ariſes towards the back part of the Edge of the *Os Ilium,* by the oblique Aſcent of its Fibres to the Cartilaginous Endings of the Ribs, not only depreſſes them and ſtreightens the Cavity of the *Thorax* in Exſpiration, but in regard the Order of Fibres in this Muſcle interſects thoſe of the *Deſcendens,* theſe two Muſcles muſt antagonize each other in the Rotation of the Trunk of the Body on the Axis of the *Vertebræ.* In the Structure and reciprocal Co-operation of theſe Muſcles, the aſcending on the right ſide, and the deſcending on the left, turning the Body to the right; and *vice verſa,* the aſcending on the left, and deſcending on the right ſide; in like manner turning it to the left, the Art of Nature is very admirable, which is particularly taken notice of, and accurately deſcrib'd by * *Archangelus Piccolominus.*

III.

Tab. I. XV.

PYRAMIDALIS *vel* SUCCENTURIATUS.

THIS Muſcle lying on the *Rectus,* preſents it ſelf next in order of Diſſection. It has its Name from its Figure, aptly repreſenting a Pyramid. It ariſes from the ſuperiour part of the *Os Pubis,* and in its Aſcent leſſens gradually, till it becomes a long Tendon inſerted into the Navel. † *Maſſa* is the firſt that (I find) takes notice of theſe Muſcles, but thinks they belong to the *Penis.* ‡ *Riolan* has obſerv'd the left pyramidal Muſcle to be commonly the leſſer of the two; and if either be abſent, it is uſually that. ** *Fallopius* conjectures they compreſs the Bladder of Urine. *Fabritius ab Aquapendente* imagines they ſupport the *Abdomen,* and hinder the upper Parts from preſſing too violently on the inferiour; but this Opinion ſeems to take its Riſe from obſerving the anatomical Subject in a ſupine Poſition. When the Diaphragm is in Action, and the *Viſcera* of the *Abdomen* are thereby preſs'd downwards, the pyramidal Muſcles acting at the ſame time, make a more adequate Compreſſion of the Bladder in the Expulſion of the Urine, than any other Muſcle of this Part; though it muſt be confeſs'd that all the Abdominal Muſcles aſſiſt in that Action. They are called SUCCENTURIATI, or auxiliary Muſcles, from a Suppoſition that they are only ſupplemental to the *Recti,* the Order of Fibres agreeing in both, and theſe being generally abſent when the *Recti* are continued fleſhy to the *Oſſa Pubis.*

IV.

Tab. I. II. XVI.

RECTUS,

SO called from the Rectitude of its Poſition. Anatomiſts differ in aſſigning the Origination of this Muſcle, ſome deriving it from the *Sternum,* others from the *Oſſa Pubis;* but this ſeems a matter more of Controverſy than Uſe, ſince

* *Prælect. Anatom.* p. 74. † Chap. XXI. ‡ *Anthropolog. lib.* V. *cap.* XXXIV. ** *Obſerv. Anatom.*

either

either Part is indifferently mov'd by it, when the oppoſite remains ſtable. Little can be added to the common and well known Deſcription of theſe Muſcles, they being continued according to the Length of the lower Belly from the *Cartilago Enſiformis*, two of the Cartilages of the true, and two of the baſtard Ribs, down to the *Os Pubis*; and divided into four or five Portions, by three or four tranſverſe tendinous Interſections. The Veſſels, which paſs underneath the upper Part of this Muſcle, are the Mammary Artery deſcending, and its Vein aſcending. Thoſe of its lower Part are the Epigaſtrick Artery aſcending, and its Vein deſcending. The Incloſure of this Muſcle in the double Tendon of the *Aſcendens* we could never as yet diſcern, rather ſuſpecting, that the Adheſion of the Tendon of the *Aſcendens* to that of the following Muſcle, in the *Linea Semilunaris*, might occaſion the Miſtake.

V.

Transversalis.

Tab. II. V. XVI.

SO called, becauſe its Fibres run tranſverſly over the *Abdomen*. This Muſcle does not ariſe, according to the common Tradition, from any Ligament, whether ſpringing from the *Os Sacrum*, or covering the *Sacrolumbus*; but, as *Realdus* * *Columbus* has it, from the tranſverſe Proceſſes of the Lumbal *Vertebræ*, where it is a thin Tendon, and fleſhy from the Spine of the *Os Ilium*, *Ligamentum Pubis*, and the cartilaginous Endings of the Ribs below the *Sternum*, whence its fleſhy Part paſſes over the convex Surface of the *Peritonæum*, and becomes a broad expanded Tendon, before it runs under the *Rectus* to its Implantation into the *Linea Alba*. Sometimes part of the Tendon of the Transversalis paſſes over the inferiour Part of the *Rectus*, as appear'd in a Subject I lately diſſected, and the upper Part of its Tendon was plainly continued to the *Linea Alba* under the *Rectus*. Perhaps ſuch like Sportings of Nature, may give occaſion to thoſe irregular Ruptures, which we ſometimes find.

When this Muſcle with its Partner act, they preſs the *Peritonæum* directly inwards, and conſpire with the reſt of the Muſcles of the *Abdomen*, together with the Diaphragm, in compreſſing the Contents of the Belly. The Tendons of the two oblique Muſcles, before they march over the *Rectus* on either Side, being join'd to the Tendon of this Muſcle in the *Linea Semilunaris*, do include the *Rectus* in a tendinous Caſe; which ſeems no inconſiderable Contrivance of Nature to corroborate the incloſed *Rectus* in its Action. *Caſpar* † *Bartholin* obſerves in Bulls and other Animals of large Size, that Part of the Transversalis is continuous with the Diaphragm at the cartilaginous Endings of the Ribs below the *Sternum*, whence he ſuppoſes the Diaphragm to be a trigaſtrick Muſcle. In human Bodies we find, that the Diaphragm and this Muſcle are both fix'd to the cartilaginous Endings of the Ribs. The ſpermatick Veſſels paſs through this and the aſcending Muſcle near the *Inguina*, in the mid-way between the fore Part of the Spine of

* *De Re Anatom. lib.* 5. *cap.* 22. † *De Structura Diaphragm. cap.* 2.

the *Os Ilium*, and the *Os Pubis*; whence deſcending for ſome Space between the fleſhy Part of the *Obliquus Aſcendens*, and the Tendon of the *Deſcendens*, they run through a Fiſſure in that Tendon near the *Os Pubis.* Nature has artificially diſpoſed theſe Perforations not exactly opening againſt one another, in order to prevent a *Prolapſus* of the Inteſtines through them. Which Contrivance is not much unlike the oblique Inſertion of the *Ureters* and *Ductus Bilarius* paſſing between the Membranes of the Bladder, and the Inteſtines, whereby the Return of the Urine in one, and the Bile in the other, is prevented.

BESIDES theſe Muſcles of the *Abdomen*, the Diaphragm may not improperly be reckon'd among them; ſince without its Co-operation, the abdominal Muſcles would not be able to compreſs the Contents of the lower Belly ſufficiently for the Excluſion of the Excrements, &c. But the Diaphragm being a principal Inſtrument in Reſpiration, we chooſe to treat of it among the Muſcles of the *Thorax*.

N. B. In the Diſſection of the tranſverſe Muſcles, Care muſt be taken not to wound the Cremaſter *on either Side.*

WE proceed now to the Muſcles of thoſe Parts, which for Conveniency of Diſſection offer themſelves next, namely, the Teſtes, Penis, *Bladder of Urine, and* Anus: *In order to which, the Diviſion of the Skin, Fat, and Membranes, muſt be continued, by a ſemicircular Section on each Side of the* Pubes, *meeting in the* Perinæum *near the* Anus, *after which the Operator muſt begin to raiſe the Skin of the upper Part of the* Penis, *freeing it from the ſpermatick Veſſels, and next raiſing that Part, which lies in the* Perinæum. *This being done and the Fat remov'd, the following Muſcles offer themſelves to view.*

Chap. II.

Of the MUSCLES *of the* Testes.

EACH Teſticle is attended with one proper Muſcle call'd *Cremaſter*, to which * *Riolan* adds another, and thinks it common to both, comprehending them in the manner of a Bag; but other Anatomiſts take it for a Membrane only, and call it *Dartos*.

VI.

Cremaster, *or* Suspensor Testiculi.

Tab. xv. xvii.

IT ariſes fleſhy from the fore Part of the Spine of the *Os Ilium*, its Fibres running parallel with thoſe of the *Obliquus Aſcendens*, (not with thoſe of the *Tranſverſalis*, as † *Bartholin* maintains againſt *Riolan*,) and almoſt encompaſſing the Proceſs of the *Peritonæum*, deſcends to the lower Part of the Proceſs, which incloſes the Teſticle. Its Name declares its Office.

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* *Anthropolog. lib.* 5. *cap.* 36. † *Lib.* 1. *cap.* 22.

CHAP. III.

Of the MUSCLES *of the* PENIS.

ANATOMISTS generally deſcribe two Pair of Muſcles belonging to the *Penis, viz. Acceleratores* and *Erectores.* Beſides theſe, we ſometimes meet with a third Pair mentioned and figured by *Stephen* * *Riverius.*

VII.

Tab. xvii. xix.

ACCELERATOR URINÆ.

SO called from its Action, in promoting the Ejection of the Urine and Seed. Authors have been miſtaken in aſſigning the Origination of this Muſcle in Men, either to the *Sphincter Ani,* or the Tubercles of the *Oſſa Iſchii;* it ariſing fleſhy from the ſuperiour Part of the *Urethra,* as it paſſes under the *Oſſa Pubis,* and incompaſſing the external Part of the Bulb of its cavernous Body, on which its two Sides meet and join each other in the *Perinæum,* the whole being one Muſcle, and not two. But on that Part of the *Urethra,* from which the *Scrotum* is pendulous, its Sides part again from each other, with two fleſhy Elongations, which become thin Tendons at their Inſertions on each Side into the *Corpora Cavernoſa Penis,* nor do they terminate on the Sides of the *Urethra,* as ſome Anatomiſts pretend. But the Variety we meet with of Nature's Sportings in theſe Muſcles, more than in thoſe of other Parts, may perhaps be the occaſion, that Authors differ ſo much in their Accounts of them.

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* *Lib.* 2. *P.* 196.

BESIDES

BESIDES the Uſe of this Muſcle in compreſſing the *Urethra*, and thereby driving out the Remains of the Urine, and promoting the Ejaculation of the *Semen in Coitu*, (which Action is chiefly performed by the laſt deſcribed Part of it embracing the *Urethra*, as its two Sides, after parting from each other, paſs to their Inſertions on each Side the cavernous Bodies of the *Penis)* it alſo aſſiſts the following Muſcles in the Erection of the *Penis*, by driving the Blood contain'd in the Bulb of the cavernous Body of the *Urethra* towards the *Glans* in greater Quantity, whereby the *Glans* becomes diſtended. The Veins, which carry back the refluent Blood from the *Corpus Cavernoſum Urethræ*, are alſo at that time compreſt by the Intumeſcence of this Muſcle.

VIII.

ERECTOR PENIS,

Tab. XVII. XIX.

BY ſome call'd *Director*, and by * *Spigelius*, *Collateralis Penis*. It ariſes fleſhy from the external Knob of the *Os Iſchium*, below the Beginning of the cavernous Body of the *Penis* on each Side, into the thick Membrane of which it is inſerted.

WHEN this Pair of Muſcles act, they pull the *Penis* towards the *Oſſa Pubis*, whereby its great Vein is compreſt, and the refluent Blood ſtopp'd in its Paſſage under thoſe Bones, by which means the *Penis* is erected.

IX.

TRANSVERSALIS PENIS.

Tab. XVII, XIX.

SO called from its Situation. Theſe Muſcles are mention'd by *Lindanus* after *Fabricius ab Aquapendente*, as *Thom. Bartholin* takes notice. They ariſe near the former, from whence they paſs tranſverſly to their Inſertions, at the upper Part of the Bulb of the cavernous Body of the *Urethra*.

To theſe may be added the Muſcles of the *Clitoris*, and that of the *Pudendum*, in Women.

ANATOMISTS differ concerning the Number of the Muſcles belonging to the *Clitoris*; ſome with *Falloppius* (who firſt obſerved them) reckon one Pair only; others two; but *de Graaf* inclines to the firſt Opinion, which we alſo think moſt agreeable to Truth. Authors have not beſtow'd any proper Names upon them, but ſince they agree ſo exactly with the *Erectores Penis* (above treated of) except only in Magnitude; the ſame Appellation may likewiſe ſerve here.

* *Lib.* 4. *cap.* 12.

X.

Tab. XVIII.

ERECTOR CLITORIDIS.

THIS ariſes fleſhy from the external Margin of the *Os Iſchium*, and is implanted into the Beginning of the cavernous Body of the *Clitoris*.

THE Action and Uſe of this and its Partner, is the ſame with that of the *Erectores Penis*. The other Pair of Muſcles aſcribed to this Part by ſome Anatomiſts, and figured by *de Graaf*, are only Portions of the following Muſcle, adhering to it.

XI.

Tab. XVIII.

SPHINCTER VAGINÆ.

THIS lies immediately under the *Clitoris*, incompaſſing the *Vagina* with circular Fibres, three Fingers in breadth. In ſome Subjects it ſcarcely appeareth fleſhy.

THIS in its Action, not only ſtraitens the *Vagina*, but thereby alſo ſtops the Blood in its Return from the *Plexus Retiformis* of the *Pudendum*, by compreſſing ſome of its Veins which lie underneath, by which means the *Labia* become diſtended, and the *Vagina* contracted.

Chap. IV.

Of the MUSCLES *of the* Bladder *of Urine.*

G*ALEN* * and the ancient Anatomists take notice of but one Muscle belonging to this Part, *viz.* the *Sphincter*, but *Fabricius ab Aquapendente* mentions another, call'd by *Spigelius*, *Detrusor Urinæ*, from its Use.

XII.

Detrusor Urinæ.

Tab. xviii.

This by some is reckon'd the first proper Membrane of the Bladder, lying under that which is continued from the *Peritonæum*. Its carneous Fibres embracing the whole Bladder, compress it in the Evacuation of the Urine.

XIII.

Sphincter Vesicæ.

Tab. xviii.

Falloppius † observes, that the Anatomists of his time had not well described the Situation of this Muscle, they placing it below the *Prostatæ*; in which Case, (as he alledges) the *Semen* could not be emitted in Coition, without

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* *Lib. de Muscul.*

† *Observ. Anat.*

the

the Urine. Yet it ſeems his Contemporary *Columbus* * was not unacquainted with its true Appearance. *Natura prudens*, ſays he, *Muſculum tenuem poſuit, orbicularem, circularibus Fibris, qui Veſicæ Collum conſtringit.* This Muſcle is ſeated in that Part of the Neck of the Bladder, which lies immediately under the upper part of the *Glandulæ Proſtatæ*. Where, as *Falloppius* ſays, † " You muſt not expect " to find an entire Muſcle and Subſtance diſtinct from the ſubject Canal, like that " of the *Anus*, but the more fleſhy part of the Neck of the Bladder compoſed of " many tranſverſe Fibres, whoſe Contraction hinders the involuntary Egreſs of the " Urine.

N. B. To diſcover theſe tranſverſe Fibres, our Author adviſes to dip the Bladder in ſcalding Water after Inflation, when the external right Fibres being removed, theſe will appear underneath. By blowing up the Bladder, and drying it, after the *Proſtatæ* were remov'd, we have diſcover'd the tranſverſe Fibres of the *Sphincter*, as repreſented in Tab. XVIII. 13.

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* *Lib. 5. cap. 26.* † *Obſ. Anatom.*

Chap. V.

Of the MUSCLES *of the* Anus.

VARIOUS Accounts are given us by Anatomiſts of the Muſcles of the *Anus*. *Galen* * divides its *Sphincter* into two, *viz. Carnoſus* and *Cutaneus*; which, with the two *Levatores*, make four Muſcles belonging to this Part. *Riolan* † multiplies them to the Number of nine, three *Sphincters*, *Carnoſus*, *Cutaneus*, and *Vaginalis*; and ſix Elevators, two internal, and four external, of which one Pair belongs to the *Os Coccygis*. But this Opinion ſeems rather grounded on Fancy, or ſome particular Subject, than the general Appearance of them in Diſſection.

XIV.

Sphincter Ani. *Tab.* XIX. XX.

THIS is a large, thick, fleſhy Muſcle, incompaſſing the *Anus*. Its Figure and Series of Fibres externally, immediately under the Skin, incline to a longiſh Oval. It is connected forwards to the *Accelerator Urinæ*, backwards to the *Os Coccygis*. As it is continued farther upon the Body of the *Inteſtinum Rectum*, its Fibres are circular for near two Inches in Breadth. It is much larger in Man, than in other Animals, in whom, by reaſon of the erect Poſition of the

* *De Muſculis.* † *Anthropolog. lib.* 5. *cap.* 40.

Body, there is greater Force required to retain the *Fæces*, which is the Office of this Muſcle.

XV.

Tab. xix. xx.

LEVATOR ANI.

SEEMS to be one Muſcle, ſpringing fleſhy from each Side the *Oſſa Pubis*, internally within the *Pelvis*, as alſo from part of the *Iſchium* and *Sacrum*. From theſe Places, like Lines drawn from a Circumference towards a Center, its Fibres deſcend over the *Muſculi Marſupiales*, to their Implantation at the lower end of the *Inteſtinum Rectum* in the *Anus*. Beſides the Action aſcribed to this Muſcle, which its Name imports, it has a farther and more remarkable Uſe, which will appear to any, who examine its Poſition. For in its Deſcent on each Side from the *Oſſa Pubis*, you'll find it paſſing cloſe over the *Glandulæ Proſtatæ*; and its back Parts deſcending from the *Os Iſchium* and *Sacrum* muſt neceſſarily compreſs the *Veſiculæ Seminales*, by drawing up the *Anus* with the lower Part of the *Rectum*, not unlike the Diaphragm in compreſſing the Contents of the lower Belly. This Muſcle therefore, when it acts, will force out the Contents of the *Proſtatæ* and *Veſiculæ Seminales* into the *Urethra*, the Diaphragm, with the reſt of the Abdominal Muſcles, making a counter Preſſure at the ſame time, and thereby aſſiſting it to drive out the *Semen in Coitu*.

CHAP. VI.

Of the MUSCLES *of the* HAIRY-SCALP *and* FOREHEAD.

TO demonſtrate theſe Muſcles, make Inciſion through the common Integuments of the Head, the firſt and direct Line of Diviſion being continued from the middle and inferiour part of the Os Occipitis, *to the ſame part of the* Os Frontis. *The other muſt be made tranſverſly from two Inciſions round each Ear, to the* Sinciput. *Begin to raiſe the Skin at its Angles, on the* Sinciput, *taking great care, in freeing the Skin of the Forehead, not to raiſe the Frontal Muſcles.*

XVI.

OCCIPITALIS.

Tab. xx.

THIS and its Partner were firſt diſcover'd by *Columbus*, and accurately deſcribed by *Falloppius**, who took himſelf to be the firſt Inventor of them. " In Occipitio, ſays he, Muſculi reperiuntur à reliquis omnibus Anatomicis præ- " termiſſi." They are ſhort, but broad, thin, fleſhy Muſcles, ſituate on the *Occiput*, from whence they derive their Names. Each of theſe ariſes fleſhy from that Part of the *Os Occipitis*, where the *Maſtoideus* and *Muſculus Splenius* are inſerted, and ſoon becoming Tendinous, joins with the *Pericranium*; which firmly ad-

* *Obſ. Anatom.*

heres

heres to the Hairy-Scalp on the *Sinciput.* When theſe act, they pull the Hairy-Scalp backwards; which Action *Columbus* tells us, he had often ſeen with pleaſure in the Head of his Maſter *Johannes Antonius Plat,* who was wont to move the whole Skin of his Head very freely.

IT is certain the Tendons of the Occipital Muſcles are continued with the *Frontales*; and, though Anatomiſts have given them two different Names, the *Occipitalis* and *Frontalis* on each Side are really one Digaſtrick Muſcle, which ſerves to draw the Hairy-Scalp backwards or forwards, as either fleſhy End is contracted. But, becauſe I would avoid Innovation as much as poſſible, I ſhall ſtill retain the uſual Diſtinction.

XVII.

FRONTALIS.

Tab. XX. XXI. XXII.

ITs Riſe is already mention'd in deſcribing the Occipital Muſcles, beſides which it has other Originations, or fix'd Points, to which the Skin of the Forehead is drawn, when its fleſhy Fibres are contracted. From theſe Points ariſe two ſeveral Productions of this Muſcle on each Side, the external of which ſprings from the lower part of the Bone of the Noſe near the *Ala.* The other internal, and more fleſhy Production, which is broader than the external, lying partly under the *Orbicularis Palpebrarum,* ſprings from the Margin of the *Os Frontis,* that makes the upper part of the Orbite of the Eye, near the great *Canthus.* This in its oblique Aſcent becomes thick and fleſhy on the Eyebrow, and afterwards the two Productions uniting compoſe that fleſhy Body under the Skin of the Forehead. Though theſe Parts of the Frontal Muſcle act ſeparately, whether in lifting up the Eyebrows, and wrinkling the Skin of the Forehead, or in drawing the Eyebrows down, and corrugating the Skin between them, which we call knitting the Brows; yet I ſee no reaſon to make them diſtinct Muſcles. That part of it expreſs'd Tab. XXV. Fig. V. at *b,* was firſt taken notice of by *Vocherus Coiter,* and has been ſince call'd *Corrugator.*

Tab. XX. *a, b, and Tab.* XXV. *Fig.* V. *a, b.*

N. B. *To raiſe the Skin, and diſcover the Muſcles of the Face, which in the Order of Diſſection are next to be proſecuted, continue your former Diviſion from the* Dorſum Naſi, *where you left it, to its* Apex; *and from two Semicircular Sections, one on each Side the* Alæ Naſi *to the* Septum Narium, *make a direct one to join with a Circular Inciſion round the Lips. Then from the middle of the lower Lip, draw your Knife directly over the Chin, Neck, and* Sternum, *till you meet that longitudinal one made in Diſſection of the Muſcles of the* Abdomen. *The Skin is beſt cleared from the Eyelids, after raiſing it from the circumjacent Parts. In this Operation ſpecial Attention muſt be had, leſt you wound the* Orbicularis Palpebrarum, *and Muſcles of the* Alæ Naſi. *Care alſo muſt be taken in raiſing the Skin of the Neck, and Face, not to raiſe the* Quadrati Genarum *along with it.*

CHAP.

CHAP. VII.
Of the MUSCLES *of the* CHEEKS *and* LIPS.

THE Defcriptions and Ufes of thefe Mufcles given by Anatomifts, are fo various, that to recite their feveral Accounts of them would be exceedingly tedious to the Reader, and at the fame time of very little Ufe. For which reafon I fhall only reprefent them, as they have appear'd to my felf in fome late Subjects.

THE Mufcles of the Lips are either *Common* to the Cheeks and Lips, or to both Lips, or *Proper* to the upper, or under Lip only.

THOSE *Common* to the Cheeks and Lips, are two Pair, on each Side two Mufcles, *viz.* the *Quadratus* and *Buccinator*.

XVIII.
QUADRATUS GENÆ, *or* QUADRATUS COLLI, *by fome call'd* Tetragonus, *and by* Galen, Platyfma Myoides. *Tab.* I. xxi.

HAs a thin Membranous Beginning, according to *Galen**, from the Spines of the *Vertebræ* of the Neck, and from the Skin on the *Cucullaris* and Pectoral Mufcle; whence afcending with an oblique Courfe of flefhy Fibres, on the Side

* *De Mufculis.*

of

of the Neck, it is faſtened to the *Proceſſus Maſtoides* and root of the Ear; after which it paſſes over the lower Side of the inferiour Jaw-bone, the Parotide Gland, and *Maſſeter* Muſcle, and is at length inſerted into the Cheek, the Angle of the Mouth or Lips, and the middle of the lower Jaw-bone, where its Fibres in ſome Subjects decuſſate thoſe of the other Side.

WHEN both theſe Muſcles act, they pull down each Angle of the Lips, together with the Cheeks, and part of them may aſſiſt the Digaſtrick Muſcles in opening the Mouth.

XIX.

Tab. XXI. XXII. XXIV.

BUCCINATOR.

THIS Muſcle does not ſpring from the Gums of the upper, and end in thoſe of the lower Jaw; nor is it of that Figure, which ſome Anatomiſts would perſuade us, or interwoven with various Orders of Fibres, as others pretend. It ariſes broad and fleſhy from the fore-part of the *Proceſſus Corone* of the lower Jaw-Bone, from whence it proceeds with direct Fibres to its Inſertion at the Angle of the Lips. Through the middle of this Muſcle paſſes the *Ductus Salivalis ſuperior*, which was obſerv'd by *Placentinus*, and by him call'd *Vinculum Robuſtum.*

BESIDES the Uſe, which Trumpeters make of theſe Muſcles acting together, either of them contracting alone pulls the Lips to one Side.

THE Muſcles common to both Lips are ſuch as are inſerted into their Angles, as the *Zygomaticus*, *Elevator*, *Depreſſor*, and *Conſtrictor Labiorum.*

XX.

Tab. XXI. XXII. XXIII.

ZYGOMATICUS.

SO called, becauſe it ariſes from the *Os Jugale*, or *Zygoma*. Its Origination is round and fleſhy from the external part of that Bone, whence deſcending obliquely forwards, it is inſerted near the Angle of the Lips. In ſome Subjects I have found it divided at its Termination.

WHEN this Muſcle and its Partner act together, they draw both Lips upward; but if one of them acts alone, it diſtorts the Mouth, whence it is by ſome called *Diſtortor Oris.*

XXI.

Tab. XXI. XXII.

ELEVATOR LABIORUM.

THIS lies between the former Muſcle and the *Elevator Labii Superioris Proprius.* It ariſes from the fourth Bone of the upper Jaw, and deſcends directly to its Inſertion under the Termination of the former Muſcle.

XXII.

DEPRESSOR LABIORUM.

Tab. XXI. XXII. XXIII.

THIS arifes flefhy from the lower edge of the inferiour Jaw-Bone laterally, whence it afcends to its Infertion at the Angle of the Lips.

THIS draws down the Corner of the Lips.

XXIII.

ORBICULARIS LABIORUM.

Tab. XXI. XXII.

THIS environs the Lips with Circular Fibres, and is called *Conftrictor*, or *Sphincter Labiorum*, as likewife *Ofculatorius*, from its Ufe.

THE Mufcles *Proper* to the upper, or under Lip, are three Pair, viz. *Elevatores Labii Superioris Proprii*, *Depreffores*, and *Elevatores Labii Inferioris Proprii.*

XXIV.

ELEVATOR LABII SUPERIORIS PROPRIUS.

Tab. XXI. XXII.

THIS arifes flefhy from the fore part of the fourth Bone of the upper Jaw, immediately above the *Elevator* treated of before, and defcends obliquely under the Skin of the upper Lip, joining with its Partner in a middle Line, from the *Septum Narium* to its Termination in the *Sphincter Labiorum*. It has a double Series of Fibres. The external defcend obliquely from its Origine, and are very thin. The internal decuffate the former at Acute Angles, and pafs in an arched manner under the *Alæ Nafi*, feeming to be a continuation of the *Orbicularis Labiorum*. The external Series give Slips of flefhy Fibres to the two Cartilages of the *Alæ Nafi* at their meeting with the *Septum*. Thefe make the Furrow in the middle of the upper Lip, under the *Septum Narium*.

XXV.

DEPRESSOR LABII INFERIORIS PROPRIUS.

Tab. XXI. XXII. XXXI.

ITs difficult to determine, whether this be one, or two Mufcles. It lies between the *Depreffores Labiorum Communes*, defcribed above, poffeffing that part of the lower Jaw called the Chin, and afcending with a twofold order of Fibres, one direct, and the other tranfverfe, is inferted into the lower Lip; in depreffing which, it turns it outwards.

XXVI.

Tab. xxxi.

Elevator Labii Inferioris Proprius.

This Mufcle with its Partner lies within the lower Lip, and was firft obferv-ed by us fome time fince. It arifes flefhy from the fore part of the lower Jaw-Bone, below the Gums of the *Dentes Inciforii,* and defcends directly to its Infertion into the inferiour part of the Skin of the Chin. When thefe Mufcles act, they make divers Indentations in the Skin of the Chin, as may be obferv'd in living Subjects, when the lower Lip is drawn upwards.

CHAP. VIII.

Of the MUSCLES *of the* EYE-LIDS.

G*ALEN* * and the ancient Anatomiſts, together with *Veſalius* † and ſome later Writers, are extremely deceived in their Notion of theſe Muſcles, in dividing the *Orbicularis* into two, and ſuppoſing thereby all the Motions of the Eye-Lids to be perform'd. But this Syſtem was firſt alter'd by *Falloppius* **, partly from an Intimation of *Oribaſius* in his Book *De Diſſect. Muſcul. ex Galeno*, Cap. VI. where he takes Notice, that in the Cure of an *Ægilops*, not only the deſcribed Beginnings of the Orbicular Muſcles are cut and burnt away, but the Bone underneath exfoliated, and yet the Motions of the Eye-Lids remain; and partly from the Diſſection of the Eye in a Sea-Calf, where he obſerved four Muſcles latent in the Orbit, inſerted above, underneath, and on both Sides the *Palpebræ*. Being induced upon this to make the like Inquiry in a human Body, he happily diſcover'd the *Aperiens Palpebram Rectus*, which ſhall be deſcribed hereafter. We mention this Paſſage, becauſe ſome later Authors have favoured the erroneous Account of the former Anatomiſts, retaining their Deſcription of the *Orbicularis Palpebrarum*, and dividing it into two Semicircular Muſcles.

XXVII.

ORBICULARIS PALPEBRARUM.

Tab. XXI. XXII. XXV. *Fig.* I.

THIS is a thin fleſhy Muſcle, whoſe Fibres do circularly environ the Eye-Lids, and are inſerted into them, (like the *Sphincter Labiorum)* not adhering to any Bone, from whence we may derive their Origine, except the ſuperiour part of the great Bone of the Noſe; by ſome reckoned the fourth Bone of the upper Jaw.

THIS Muſcle, acting like the Sphincters of other Parts, conſtringes the Eye-Lids. To theſe *Riolan* ‡ adds another Muſcle belonging to each Eye-Lid, which

* *De Diſſectione Muſcul.* † *Hum. Corp. Fabric. lib.* 2. *cap.* 10. ** *Obſerv. Anatom.*
‡ *Anthropog. lib.* 5. *cap.* 10.

he

he calls *Ciliaris*, which we take to be a Portion of the former adjacent to the *Cilia*.

To discover the following Muscle, part of the former lying between the upper Eye-Lid and Eye-brow, must be raised: After which, the Glandula Lachrymalis, *with part of the Fat within the* Orbit *being removed, by extending the upper Eye-Lid, either with a Hook, or your Fingers only, its tendinous Insertion and fleshy Body will appear.*

XXVIII.

APERIENS PALPEBRAM RECTUS.

Tab. XXV. *Fig.* 1.

SO called from its streight Progress and Use. It arises sharp and fleshy from the profoundest part of the *Orbit*, near the place where the Optick Nerve is transmitted; and passing directly over the *Musculus Attollens*, it becomes tendinous, as it marches over the Bulb of the Eye; where growing still broader and thinner, it is inserted into the whole superiour part of the upper Eye-Lid.

THESE Muscles of the Eye-Lids being removed, we proceed next to those of the Eye itself, in the Demonstration of which, Fabricius ab Aquapendente **proposes two ways; the one shewing the Eye with its Muscles* in situ, *the other the Eye taken out of its Cavity, and its Muscles expanded on the Table: The first exhibiting their Motions, the second their Figure or Shape. In the first, though our Author advises the Brain to be taken out, and the Bones of the* Orbit *to be divided; yet we chuse to perform this Operation in the following manner, without troubling our selves with either. Both Eye-Lids being removed, first with your fore Finger feel gently for the* Trochlea, *situated near the brink of the* Orbit, *towards the Nose; then clear the Tendon which passes through it. This done, in like manner clear the opposite Muscle, the* Obliquus Inferior, *first observing its Origination at the brink of the inferiour part of the* Orbit; *then with the Assistance of a small Hook and Scissars extract the Fat, Membranes, and Vessels, from between the streight Muscles. The other manner of Demonstration may be practised in the same Eye, or the opposite, taking care in freeing the* Trochlea *from the* Orbit, *to avoid wounding the Tendon, which passes through it. The inferiour oblique Muscle being cut off close from its Origine, as also the rest of the Muscles, and the Optick Nerve at the profoundest part of the* Orbit, *and the whole Eye being dislodg'd; disengage its Muscles, and display them, whereby you may observe, that the* Trochlearis *is the longest Muscle of the Eye; and that its Insertion is directly behind the* Attollens; *and on the contrary, that the* Obliquus Inferior *is the shortest, whose Termination is directly behind the* Abducens, *by which means you may distinguish the right Eye from the left.*

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* *De Visione. Cap.* 11.

CHAP.

CHAP. IX.

Of the MUSCLES *of the* EYE.

COLUMBUS * reprehends *Galen*, *Vesalius*, and the Anatomists of this Time, for ascribing the *Aperiens Palpebram Rectus* and *Obliquus Superior* to the Eye, and at the same time commits no less an Error himself, not only in supposing, that the last named Muscle belongs to the Eye-Lid, but likewise in imagining, that the *Obliquus Inferior* begins and ends in the *Cornea* of the Eye. But the accurate *Falloppius* †, who first observed the *Trochlea*, has given us the most exact Description of these Muscles of the Eye, as well as those of the *Palpebræ*.

XXIX.

OBLIQUUS SUPERIOR *or* TROCHLEARIS.

Tab. XXV. *Fig.* I. II. III. IV.

IT receives its first Denomination from its oblique Position and Course, in regard of the rest of its Fellows. The second it derives from that Cartilaginous Ring, placed near the Brink of the upper Part of the *Orbit* towards the Nose, through which its Tendon passes, being reflected on it, as a Rope on a Pully. Besides which, it is called *Longissimus Oculi*, as exceeding the others in length. It arises sharp and fleshy from the profoundest Part of the *Orbit*, near the Origination of the *Adducens*, and becoming a fleshy Belly, as it passes obliquely close under the superiour Part of the Bone of the *Orbit*, it makes a round Tendon running through the *Trochlea* (as above mentioned;) from whence reverting back, it's inserted into the *Tunica Sclerotis*, in the mid way between the Termination of the *Attollens* and Optick Nerve, towards the back Part of the Bulb of the Eye.

* *De re Anatom. lib.* 5. *cap.* 8. † *Obs. Anatom.*

XXX.

XXX.

OBLIQUUS INFERIOR.

Tab. XXV. *Fig.* I. II. III. IV.

ALSO called *Breviſſimus Oculi*, it being the ſhorteſt Muſcle of the Eye. This ſprings ſharp and fleſhy from immediately within the lower, and almoſt outward Part of the *Orbit*, at the Juncture of the firſt Bone of the upper Jaw with the fourth, and becoming thicker, aſcends obliquely over the *Deprimens*, growing tendinous at its Inſertion into the *Tunica Sclerotis*, near the Implantation of the former, directly betwixt the *Abducens* and Optick Nerve.

THE two oblique Muſcles are by ſome called *Circumagentes*, and *Amatorii*, from their Actions in winding and rolling the Eye about, which Motions we call Ogling. Anatomiſts differ in aſſigning the proper Offices of theſe Muſcles, ſome aſſerting when the Superiour acts, the Eye is rolled from the Noſe; when the Inferiour, to it. Others, on the contrary, ſuppoſe that the former draws it to the Noſe, and the latter directs it towards the leſſer *Canthus* of the Eye. But if we rightly conſider the Poſition of the *Trochlea*, which determines the Motion made by the Superiour Oblique Muſcle, and the Origination of the Inferiour; and that the Tendon of the former, and the whole *Ductus* of the latter, paſs obliquely from the external edge of the *Orbit* to their Inſertions at the back part of the Bulb of the Eye; we muſt neceſſarily conceive, that the vulgar Doctrines of their Motions are erroneous. For when the *Obliquus Superior* acts, the poſteriour part of the Bulb of the Eye muſt approach towards the *Trochlea*, whereby its Globe is not only drawn ſomewhat forwards, but its *Pupil* is directed downwards; ſo on the contrary, when the *Obliquus Inferior* acts, the poſteriour part of the Bulb of the Eye approaches towards the external edge of the inferiour part of the *Orbit*; its *Pupil* is directed upwards, and its whole Globe is pulled ſomewhat outwards. Hence it is that the Bulb of the Eye is more protuberant in thoſe Actions; which Contrivance in Nature ſeems very neceſſary, ſince otherwiſe the Projections of the Eye-brows and Cheeks would be liable to hinder our Proſpect, whether directly upwards or downwards. Beſides the Uſes of theſe oblique Muſcles now mentioned, they have ſtill a more notable one, not only in pulling the whole Eye directly forwards, but in holding it from being retracted, when any of the four ſtreight Muſcles act, which otherwiſe would rather draw it inwards, then turn it either ſideways, or upwards, or downwards. But theſe Muſcles, one of them deſcending inwardly from the uppermoſt, and the other aſcending from the lowermoſt edge of the *Orbit* to their Inſertions, prevent its being drawn back into the *Orbit*, and ſerve as an Axis for the Motions of the other Muſcles. Hence it is, when they ceaſe to act, the whole Globe of the Eye ſinks, which may give occaſion for that vulgar Tradition, that the Eye-ſtrings break in dying Perſons.

THE reſt of the Muſcles of the Eye are called *Recti*, from their ſtreight Progreſs and Uſe.

XXXI.
ELEVATOR OCULI.

Ibid.

IS alſo called *Superbus* from its moral Signification, it being one of the common Marks of a haughty Diſpoſition to toſs up the Eye; wherefore its oppoſite Muſcle is called *Humilis*; but *Placentinus** thinks the Motions of the upper Eye-lids denote thoſe Diſpoſitions more ſignificantly; for ſays he, *Qui enim hanc elatam habent*, (ſpeaking of the upper Eye-lid) *Superbi & Feroces ſunt*; *qui vero depreſſam ac dimidium fere Oculum Claudentem, ita ut Terram adſpicere videantur, Humiles ac Mites ſunt.* This Muſcle ariſes ſharp, and fleſhy, near the place where the *Optick Nerve* enters the *Orbit*, and becoming a fleſhy Belly, makes a thin Tendon inſerted into the *Tunica Sclerotis*, on the Superiour and Fore-part of the Bulb of the Eye under the *Adnata*.

XXXII.
DEPRESSOR OCULI.

Ibid.

THIS, like the former, ariſes from the profoundeſt Part of the *Orbit*, and like it paſſes directly to its Inſertion into the oppoſite part of the Globe of the Eye.

XXXIII.
ADDUCTOR OCULI.

Ibid.

SO called becauſe it draws the *Pupil* towards the Noſe, and *Bibitorius*, from directing the Eye towards the Cup. The Origine and Progreſs of this is agreeable to the two former, but it is inſerted into that part of the *Tunica Sclerotis*, which borders on the Noſe.

XXXIV.
ABDUCTOR OCULI.

Ibid.

SO called from its Action in drawing the Eye from the Noſe; it is alſo called *Indignabundus*, becauſe it is made uſe of to expreſs Scorn and Reſentment. This, like the three former, ariſes near the Entrance of the Optick Nerve into the *Orbit*, and is inſerted like them into that part of the *Tunica Sclerotis*, that reſpects the leſſer *Canthus* of the Eye, oppoſite to the Implantation of the former. When theſe four right Muſcles act together, they pull the whole Globe of the Eye into the *Orbit*, from whence it's pull'd forwards again by the two *Obliqui* as before.

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* *Caſſerius, lib. 5. cap.* 18.

To theſe *Mullinete* adds * another, which he calls the Fifth Right Muſcle; the Office of which he confines to the Motion of the *Trochlea*, (ſuppoſing it moveable;) but what he has ſaid concerning it, either as to its Exiſtence, or Uſe, is ſo obſcure, if not impoſſible, that there is no Reaſon to give it any Place or Deſcription amongſt the other Muſcles of the Eye. Neither could we ever diſcover by Diſſection any ſuch Muſcle, but ſuſpect that part of the *Orbicularis Palpebrarum*, which adheres to the *Trochlea*, might occaſion the Miſtake. Which I rather remark, becauſe I find others upon *Mullinete*'s Authority, without ſtrict Enquiry into the Matter, have fallen into the ſame Error.

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* *Diſſertat. Anatom. cap.* 6.

CHAP. X.

Of the MUSCLES *of the* NOSE.

THE Nose is altogether immoveable, except in its lower griſtly Part, the Sides of which are not improperly called *Alæ* or *Pinnæ*, by whoſe Approach, or Receſs, the Noſtrils are ſtraitned, or dilated. *Galen* * aſſigns but one Pair of Muſcles to the *Alæ*, to which *Jacobus Berengarius Carpenſis* in his Commentary on *Mundinus* adds another, ariſing from the Extremities of the Bones of the Noſe, and inſerted into the inſide of the *Alæ*; wherein he is followed by *Veſalius* †. *Columbus* ‡ ſays, thoſe deſcribed by *Galen* belong to the upper Lip, and that thoſe placed in the inſide of the Noſe (above-mention'd) are entirely fictitious; deſcribing ſtill another Pair, ariſing from the upper part of the Bones of the Noſe, and inſerted into their *Alæ*. *Falloppius* ** is not poſitive, whether he has ſeen thoſe internal Muſcles mention'd by *Berengarius* and *Veſalius* or no; but he deſcribes another Muſcle, which later Anatomiſts call *Conſtrictor Alæ Naſi*; the Invention of which is claim'd by *Caſſerius Placentinus* ††. I find in general, that Nature is more inconſtant in theſe Muſcles, than in thoſe of any other Part; but the following Account is taken from their moſt common and uſual Appearance.

XXXV.

ELEVATOR ALÆ NASI.

Tab. XXI. *G, g.* *Tab.* XXII. XXV. *Fig.* V. VI.

THIS ſeems to be an Elongation of the Frontal Muſcle, continued from the upper part of the Bone of the Noſe, and deſcending obliquely to the *Ala Naſi*, where it partly joins with the following, and partly paſſes over, or ſometimes under it, to its Inſertion in the *Ala* and upper Lip.

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* *De Diſſect. Muſc.* † *Lib.* 2. *Cap.* 13. ‡ *De re Anatom. lib.* 5. *cap.* 4.
** *Obſ. Anatom.* †† *Lib.* 3. *Cap.* 9.

XXXVI.

Tab. XXV. *Fig.* V. VI.

DILATATOR ALÆ NASI, & ELEVATOR LABII SUPERIORIS.

THIS Muſcle was mention'd by *Galen.* It ariſes thin, broad, and fleſhy, from the fourth Bone of the upper Jaw; whence deſcending with a two-fold Order of Fibres, it is inſerted into the upper Lip and *Ala Naſi.*

XXXVII.

Tab. XXV. *Fig.* VI.

CONSTRICTOR ALÆ NASI.

THIS ariſes fleſhy from the fore part of the fourth Bone of the upper Jaw, immediately above the Gums of the *Dentes Inciſorii*; and aſcending, is ſoon inſerted into the Root of the *Ala Naſi.*

WHEN theſe Muſcles act, they draw the *Alæ* downwards and nearer each other.

CHAP. XI.

Of the MUSCLES *of the* AURICULA *or* OUTWARD EAR.

F*ALLOPPIUS**, the firſt Writer of theſe Muſcles, informs us there are ſometimes found three belonging to each Auricle; the Firſt or *Attollens*, the Second or *Deprimens*, and the Third, which is part of the *Platyſma Myoides*. Theſe, he ſays, are ſometimes wanting, though he has frequently ſeen them. *Placentinus* † multiplies them to the number of Five; but M. *Du Verney*, in his accurate Treatiſe of the Ear, deſcribes two only, whoſe Account we have found to be moſt agreeable to our own Enquiries.

XXXVIII.

ATTOLLENS AURICULAM. *Tab.* XXV. *Fig.* VII.

THIS conſiſts of divers fleſhy Fibres, and is annex'd to that part of the *Pericranium* that covers the temporal Muſcle, whence it deſcends directly to its Implantation at the ſuperiour part of the ſecond Wrinkle of the Cartilage of the Ear.

Its Name declares its Uſe.

XXXIX.

RETRAHENS AURICULAM. *Ibid.*

BY ſome called *Triceps Auris*, becauſe it has ſometimes three Beginnings. M. *Du Verney* ſays ‡ it is compoſed of five or ſix *Faſciculi* of fleſhy Fibres, which have their Origination from the ſuperiour and fore part of the *Apophyſis Maſtoides*, and deſcend obliquely to their Inſertion in the middle of the *Concha Auriculæ*.

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* *Obſervat. Anatom.* † *Caſſerius, lib.* 4. *cap.* 4. ‡ *De l'Org. De l'Ouie.*

N. B. *The Muſcles of the internal Ear cannot be demonſtrated, till after thoſe of the Head are diſpatch'd, and the Brain removed; but we ſhall follow the Example of others, and inſert their Deſcriptions in this Place; it being alſo cuſtomary, in the Myological Lectures at Chirurgeons Hall, to ſhew them in a dried Preparation from the precedent Subject.*

CHAP. XII.

Of the MUSCLES *of the* INTERNAL EAR.

THESE Muſcles were altogether unknown to the ancient Anatomiſts; but the moſt internal of thoſe belonging to the *Malleus* is accurately deſcribed by *Bartholomæus Euſtachius* *, and is called *Internus Auris*. *Volckerus Coiter* mentions † two Muſcles latent in the ſecond *Meatus* or *Concha*, commonly called *Tympanum*, but does not deſcribe them. His Obſervations being made from Brutes, we ſuſpect one of them was the internal Muſcle of *Euſtachius*, and the other the *Muſculus Stapedis*. *Fabritius ab Aquapendente* ‡, and *Caſſerius Placentinus* **, contend for the Invention of another lying in the *Meatus Auditorius*, called *Externus*; in the Deſcription of which they are followed by moſt Anatomiſts, except M. *Du Verny*, who (not taking notice of the Accounts of others, but writing from Diſſection only) deſcribes two Muſcles belonging to the *Malleus*, but omits the external one of *Aquapendens* and *Placentinus*; and inſtead of it adds another, which he alſo calls *Externus*, becauſe it lies on the external Bony *Paries* of the *Ductus*, leading from the Palate to the Ear, which from its Poſition we call *Obliquus Auris*. Hence it appears that three Muſcles belong to the *Malleus*, of which the firſt, that appears in Diſſection, is the *Externus* of *Aquapendens*; the ſecond is the *Externus* of *Du Verny*, which we call *Obliquus Auris*; and the third is the *Internus* of *Euſtachius*, to which may be added the fourth, belonging to the *Stapes*, called *Muſculus Stapedis*, deſcribed by *Placentinus* in Brutes, and in Man by *Du Verny*.

For the better Demonſtration of theſe Muſcles, (after the Diſſection of the Brain, and all the Muſcles, which ariſe from, or are inſerted into, the Baſis *of the* Cranium) *divide the* Os Temporale, *with part of the* Os Sphenoides *on one Side, and the* Os Occipitis *on the other, from the reſt of the Bones, (it being well cleared of the Muſcles, Membranes and Veſſels, that remain on it;) then with a ſmall ſemicircular Chiſel cut away* the

* *Opuſcula Anatomica.* † *Anatom. Obſervat.* ‡ *De Aure pars prim. lib.* 4. *cap.* 12.
** *De Aure, lib.* 4. *cap.* 13.

the inferiour Part of the Meatus Auditorius, *taking care not to wound the* Membrana Tympani. *This performed, you muſt be very cautious in raiſing the Glandulous Membrane that inveſts the* Meatus, *to which the external Muſcle adheres. The other two Muſcles of the* Malleus *lying incloſed within the* Os Petroſum, *require our next Inſpection. Firſt obſerve the laſt named Bone's Conjunction to the* Os Sphenoides, *where with the Chiſel lightly cut off their external* Laminæ, *and the oblique external Muſcle of* Du Verny *will appear, together with the Internal one of* Euſtachius. *But if you ſtill proceed to break off more of the* Os Petroſum, *you will not only have a Proſpect of the Bony Part of the* Aquæduct, *but of the Articulation of the* Malleus *with the* Incus, *and the whole Cavity of the* Tympanum. *Wherein may be obſerved the longer proceſs of the laſt named Bone, articulated with the* Stapes, *by the mediation of the* Os Orbiculare, *and the Tendon of the* Muſculus Stapedis, *running out of a Perforation in the* Os Petroſum, *down to its Inſertion in the Head of the* Stapes, *together with the internal Surface of the* Membrana Tympani, *and the long Proceſs of the* Malleus *lying on it.*

XL.

Tab. XXVI. *Fig.* I. IV.

EXTERNUS AURIS *vel* LAXATOR EXTERNUS.

THIS lies in the upper Part of the *Meatus Auditorius*, having a ſhort fleſhy Body with a long ſlender Tendon. It ariſes from the external and ſuperiour Margin of the *Meatus Auditorius*, and ſoon becoming a ſlender Tendon, paſſes directly to the upper Part of the *Membrana Tympani*, on which it deſcends for ſome ſpace to its Inſertion in the long Proceſs of the *Malleus*, where it is contiguous to the ſaid Membrane. This draws the *Manubrium* of the *Malleus*, together with the *Membrana Tympani* forwards.

XLI.

Tab. XXVI. *Fig.* I. II. III. IV. VIII.

OBLIQUUS AURIS.

THIS may be alſo called *Semicircularis* from its Poſition, it lying in the external Part of the Bony Chanel of the *Aquæduct*, whence marching ſomewhat upwards and backwards, it enters the *Tympanum* in a very oblique Sinuoſity excavated immediately above the Bone, where the *Tympanum* is inchaſed, and is inſerted into the ſlender Proceſs of the *Malleus*. The Sinuoſity, in which this Muſcle paſſes, is that, which may be taken notice of in the upper Part of the Bony Circle of the *Fœtus*. This we don't find deſcrib'd any where before *Du Verny*.

XLII.

XLII.

INTERNUS AURIS.

Tab. XXVI. *Fig.* II. III. IV. VIII.

THIS lies in a Bony Chanel in the *Os Petrosum*, which makes one of the *Parietes Tympani.* One part of this Chanel is without the *Tympanum*, and lies in the upper part of the Bony Passage, which goes from the Ear to the Palate; the other Part, which is within the *Tympanum*, advancing as far as the *Fenestra Ovalis*, makes in that Place a Rising, upon which, as on a Pully, the Tendon of this Muscle passes to the other side of the *Tympanum*, and is inserted at the posteriour Part of the Handle of the *Malleus*, a little below the Insertion of the external Muscle; by which means it draws it towards the *Os Petrosum*. The Origine of this Muscle is precisely in that Place, where the Bony Part of the *Aquæduct* terminates. It is covered with a nervous Coat, which forms a Sheath, accompanying it in its whole Progress, and binding it fast to the Chanel. When this Muscle acts, it pulls the *Manubrium* of the *Malleus* towards the *Os Petrosum*, whereby the external Surface of the *Membrana Tympani* becomes somewhat concave.

IN the Tendon of this Muscle, in some Animals, *Schelhamer* * informs us he has sometimes observed a small Bone: But we suspect he mistook the *Musculus Stapedis* for this Muscle, for in the Tendon of that my very good Friend, Dr. *Adair*, an accurate Anatomist, lately communicated his Observation of such an one to me, as it appear'd in a Calf's Head, which at first sight may deceive the Enquirer, it being annex'd to the *Stapes*, and in Figure like the *Officulum Quartum* of *Sylvius*; but if you be careful in your Examination, you may find both in the same Organ; the latter commonly remaining on the long Process of the *Incus* when separated: But if you leave the *Stapes* in *Situ*, you may see in that Animal the Origine, Progress, and Insertion of its Muscle, together with the Bone in its Tendon, as it passes over a Projection of the *Os Petrosum*, which composes the *Foramen Rotundum*, on which we suspect the Tendon of this Muscle acts, as on a *Trochlea*, to which end that small Bone is placed, not unlike the *Patella* of the Knee and *Ossa Sesamoidea* of the Feet; which is an elegant Mechanism in Nature.

XLIII.

MUSCULUS STAPEDIS.

Ibid. Fig. III. IV. VIII.

THIS lies hid in a Bony Pipe, excavated in the *Os Petrosum*, almost at the Bottom of the *Tympanum*, whence it takes its Origine. Its Belly is big and fleshy, and suddenly forms a very thin Tendon, which descends to its Insertion at the Head of the *Stapes*. The Pipe, which contains the Belly of

* *Chap.* III. *Sect.* IV.

this Muſcle, is about the ſixth part of an Inch long, and is much larger than the *Foramen,* through which its Tendon paſſes.

WHEN this acts, it draws the *Stapes* upwards to the *Foramen Ovale.*

THE Order of Diſſection obliges us to examine the Muſcles of the Os Hyoides *next, to which end the* Maſtoidei *muſt be raiſed on both ſides of the Neck; the one being freed from its Origination, and left at its Inſertion; the other on the contrary may be raiſed from its Inſertion, and left at its Origine. This done, the Biventral Muſcles of the Lower Jaw may be obſerved in their whole Progreſs, wherein may be noted, that they deſcend from their Originations, through the* Stylohyoidei, *to the* Os Hyoides, *where an* Annulus *is made on each ſide for the Tranſmiſſion of their middle Tendons; after which they re-aſcend to their Implantations. Theſe being alſo raiſed contrariwiſe, like the above-mentioned* Maſtoidei, *and the Perforations of the* Stylohyoidei *being enlarged, through which each contrary end of the* Digaſtrici *muſt be drawn, the one may be left at its Origination, and the other at its Inſertion, till we come to deſcribe the reſt of the Muſcles, which move the Lower Jaw.*

CHAP. XIII.

Of the MUSCLES *of the* OS HYOIDES, *or* BONE *of the* TONGUE.

SINCE the *Os Hyoides* is faſtned to the Tongue and *Larynx*, the Muſcles which move it ought to be eſteemed common to both. Authors diſagree concerning their Number, * *Veſalius*, † *Columbus*, ‡ *Spigelius*, *&c.* deſcribe four Pair, (*viz.*) *Par Sternohyoideum*, *Coracohyoideum*, *Stylohyoideum*, and *Geniohyoideum*. To theſe the accurate ** *Falloppius* adds another Pair, which latter Anatomiſts call *Mylohyoideum*, the Invention of which is claimed by *Riolan*, in his Animadverſions on *Caſpar Bauhin*'s *Theatrum Anatomicum*.

ALL theſe Muſcles of the *Os Hyoides* receive their Denominations from their Originations and Inſertions.

XLIV.

STERNOHYOIDEUS. *Tab.* XXII. XXIII. XXVII.

THIS does not ariſe from the upper part of the *Sternum*, as Anatomiſts generally write, but from the internal Part of the *Clavicula* next it, where its Origination is broad and fleſhy, and aſcends directly over the *Sternothyroideus* and *Larynx*, of an equal Breadth and Thickneſs, to its Inſertion at the *Baſis* of the fore Bone of the *Os Hyoides*.

THIS with its Partner acting, pull the *Os Hyoides*, together with the Tongue and *Larynx*, directly downwards.

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* *Lib.* 2. *Cap.* 17. † *Lib.* 5. *Cap.* 12. ‡ *Lib.* 4. *Cap.* 6. ** *Obſerv. Anatom.*

XLV.

Tab. XXII. XXVII.

CORACOHYOIDEUS.

THIS does not ariſe from the *Proceſſus Coracoides Scapulæ*, as ſome Anatomiſts pretend, its Origination being round and fleſhy from the ſuperiour *Coſta* of the *Scapula*, at the root of the ſaid Proceſs; whence marching obliquely under the *Maſtoideus*, it becomes tendinous; but growing fleſhy again, its inſerted into the fore Bone of the *Os Hyoides*, near the Implantation of the former Muſcle.

THIS running under the *Maſtoideus*, as on a *Trochlea*, it there becomes tendinous, not unlike the *Digaſtricus* of the Lower Jaw; wherefore this by ſome is alſo called *Biventer*. When it acts together with its Partner, they do not only aſſiſt the former in drawing the *Os Hyoides*, Tongue and *Larynx*, downwards; but they alſo pull them ſomewhat inwards, towards the *Vertebræ* of the Neck.

XLVI.

Tab. XXIII. XXIV. XXVII.

STYLOHYOIDEUS.

ARISES ſharp and tendinous from the Root of the *Proceſſus Styloides*, and ſoon growing fleſhy, deſcends obliquely forwards to the *Os Hyoides*. In half its Progreſs, it's fleſhy Body is commonly divided, for the Tranſmiſſion of the middle Tendon of the *Digaſtricus* of the Lower Jaw. After which it becomes tendinous near its Implantation into the fore and Side Bone of the *Os Hyoides*.

* *Tab.* XXVIII. *Fig.* III. X. † *Ibid.* V.

BESIDES this, I have frequently found another Muſcle*, that ariſes round and fleſhy from the *Proceſſus Styloides*; and accompanying the Ligament† between that Proceſs and the *Os Hyoides*, is inſerted tendinous with it into the *Appendiculum* of that Bone. But this not being found in all Bodies, ought not to be eſteem'd a regular Muſcle.

THESE Muſcles with their Companions, the *Styloglosſi* and *Stylopharyngæi*, acting on each ſide, do draw up the *Os Hyoides*, Tongue and *Larynx*, together with the *Fauces* in Deglutition; whereby the maſticated Aliment is not only compreſs'd into the latter, (they being then dilated) but the *Epiglottis* is depreſs'd, and adequately covers the *Rimula* of the *Larynx* by its Approximation to it, by which means the Deſcent of any part of the Aliment into the *Aſpera Arteria* is hindered; which Mechaniſm in Nature is indeed very admirable.

XLVII.

Tab. XXIII. XXVII.

MYLOHYOIDEUS.

THOUGH *Falloppius* makes this a pair of Muſcles, it ſeems not to be diviſible without apparent Violence. It poſſeſſes all that Space which is between the Lower Jaw and *Os Hyoides*; ariſing fleſhy from both ſides the Mandible internally,

nally, near the *Dentes Molares,* whence it marches with a double Order of fleſhy Fibres, the outward and lowermoſt of which paſs directly to their Implantation in the *Os Hyoides;* and thoſe in the middle run tranſverſly over the following pair of Muſcles, being inſeparably joined to each other with a middle Line.

BESIDES the Uſes commonly aſcribed to this Muſcle in moving the *Os Hyoides* Tongue, and *Larynx,* upwards and forwards, and to either Side, its laſt deſcribed tranſverſe Order of Fibres have ſtill a farther Uſe in compreſſing the *Glandulæ Sublinguales* which lie immediately under them on each ſide; whereby they haſten the Egreſs of the Spittle from the inferiour Salival Ducts into the Mouth. Hence it is we employ theſe Muſcles, when *Saliva* is wanting to moiſten the Mouth and to join with the Aliment, when Maſtication is not required; which Artifice of Nature deſerves our Admiration.

XLVIII.

GENIOHYOIDEUS.

Tab. XXIV. XXVII.

THIS with its Partner are ſhort, thick, and fleſhy Muſcles. They ariſe from the internal Parts of the Lower Jaw-Bone called the Chin, and dilating themſelves, are ſoon leſſened again, and inſerted into the ſuperiour part of the fore Bone of the *Os Hyoides.*

THESE acting, pull the *Os Hyoides, &c.* both upwards and forwards, and aſſiſt the *Genioglоſſi* in thruſting the Tongue out of the Mouth; of which in the following Chapter.

ALL theſe Muſcles of the Os Hyoides *being raiſed from their Originations, and left at their Inſertions, the whole Bone together with them may be taken out, by dividing its two Extremes from the two Proceſſes of the Scutiformal Cartilage, and cutting off the Originations of the* Ceratogloſſi *and* Hyothyroidei, *(of which hereafter.) This done, they may be expanded on a Plain, as they are repreſented in* Tab. XXVII.

L CHAP.

CHAP. XIV.

Of the MUSCLES *of the* TONGUE.

FOR the Motion of this Part, Authors aſſign various Numbers of Muſcles; ſome reckoning eight, others nine, ſome ten, and others eleven, amongſt which they count the Tongue it ſelf.

N. B. The Muſcles of the Tongue, like thoſe of the *Os Hyoides*, are named from their Originations and Inſertions.

XLIX.

Tab. XXVIII. *Fig.* I.

GENIOGLOSSUS.

THIS with its Partner lie immediately under the *Geniohyoidei.* They ariſe fleſhy from the fore part of the Lower Jaw internally, and enlarging themſelves, are inſerted into the middle part of the whole Body of the Tongue, according to its Length; and part of them ſometimes paſſes to the *Os Hyoides.*

BY the Action of the different Series of Fibres of theſe Muſcles the Tongue is either drawn in, or thruſt out of the Mouth.

L.

Tab. XXIV. XXVIII. *Fig.* I.

CERATOGLOSSUS.

THIS, in the Order of Diſſection above-mention'd, we cut from its broad fleſhy Origination at the upper part of the *Os Hyoides* laterally, whence it aſcends to its broad and fleſhy Inſertion at the Root of the Tongue.

THESE Muſcles acting together draw the Tongue into the Mouth directly; if one of them acts alone, it draws it to one Side.

LI.

STYLOGLOSSUS.

Tab. XXIV. XXVIII. *Fig.* I.

HAS a ſmall fleſhy Origination from the *Apex* of the *Proceſſus Styloides*, whence deſcending obliquely forwards, it is inſerted into the Root and Side of the Tongue, partly under the Inſertion of the former.

THIS pulls the Tongue upwards and inwards in the Action of Deglutition, as before noted.

IN my former Edition I queſtion'd the Exiſtence of a Pair of Muſcles call'd *Baſioglosſi*, on the Authority of *Falloppius* and *Julius Caſſerius*; but having ſince carefully examin'd all the Muſcles of this Part in divers Subjects, I have found them agreeable to the following Deſcription.

LII.

BASIOGLOSSUS.

Tab. XXVIII. *Fig.* I.

THE Fibres of this Muſcle, at their Origine from the *Baſis* of the *Os Hyoides*, are interſected by the hinder Parts of the *Genioglosſus*, but afterwards they paſs diſtinctly according to the Length of the Tongue to its Tip.

Chap. XV.
Of the MUSCLES *of the* Uvula.

FALLOPPIUS mentions the ſecond and third of theſe Muſcles among thoſe of the *Fauces*; but *Riolan* firſt aſcribed them to this Part, and call'd them *Pterygoſtaphylinus Internus* and *Externus*. The Diſcovery of the *Gloſſoſtaphylini* is owing to *Valſalva*.

LIII.
Glossostaphylinus.

Tab. XXVIII. *Fig.* II. *Tab.* XXIX. *Fig.* I. II.

IS a very ſmall Muſcle, conſiſting but of two or three *Faſciculi* of fleſhy Fibres, which lie immediately under the Glandulous Membrane of the *Fauces*, and make thoſe two Riſings, which we ſee on this Side the *Amygdalæ*, when we inſpect theſe Parts in living Subjects. They ariſe on each Side the Tongue, near its Root, and after a bending Progreſs are expanded on the fore part of the *Uvula*.

Their Uſe is to bring the *Uvula* downwards.

LIV.
Sphenostaphylinus.

Tab. XXVIII. *Fig.* II. IV. *Tab.* XXIX. *Fig.* I. II.

This deſcends from its Origination at a Proceſs of the *Os Sphenoides*, which is in a direct Line between the *Ala Veſpertilionis* and *Proceſſus Styloides*, and becoming a round fleſhy Belly, in half its Progreſs grows leſs again, near its lateral Inſertion into the poſteriour Part of the *Uvula*.

This with its Partner acting draw the *Uvula* upwards and backwards, which hinders the maſticated Aliment from regurgitating through the *Foramina Narium* in *Deglutition*.

LV.

PTERYGOSTAPHYLINUS.

Tab. XXVIII. *Fig.* II. IV. *Tab.* XXIX. *Fig.* I.

THIS arises from the same Process of the *Os Sphenoides* as the preceding Muscle, and like it descends according to the length of the Interstice made by the internal *Ala* of the *Os Sphenoides* and *Musculus Pterygoideus Internus* of the Jaw; and becoming tendinous, marches over the *Processus Pterygoides*, and is inserted into the fore part of the *Uvula*.

THE Tendon of this passes over the Pterygoidal Process, which like a Pully gives it a different Direction from that of the former Muscle, though they have both their Origine from the same Place. Wherefore, contrary to the preceding, this draws the *Uvula* forwards and downwards; which contrivance in Nature is no less remarkable than any of those, where the like Artifice of a *Trochlea* is made Use of.

Chap. XVI.

Of the MUSCLES *of the* Fauces.

THE Diſcovery of theſe Muſcles is aſſumed by * *Riolan*, tho' they were deſcribed before him by † *Falloppius*. Neither *Veſalius*, nor *Columbus*, mentions theſe Muſcles of the *Fauces*, or thoſe of the *Uvula*, though the Muſcles of the *Fauces* are partly deſcribed by *Galen*, *Oribaſius*, and *Avicenna*, as ‡ *Laurentius* obſerves. Later Writers have followed the erroneous Syſtem of *Riolan*, who, as I am apt to think, either received *Falloppius*'s Account implicitly, or elſe was not willing to diminiſh the Number of Muſcles belonging to the *Fauces*, deſcribed by *Falloppius*, leaſt it ſhould appear that thoſe of the *Uvula* were alſo deſcribed by him.

LVI.

Tab. xxviii. *Fig.* ii. iii. *Tab.* xxix. *Fig.* i. ii.

Stylopharyngæus.

THIS has a round fleſhy Origination at the Root of the *Proceſſus Styloides*, (with the *Styloglоſſus*) whence deſcending obliquely, it expands it ſelf at its Termination on the Internal Glandulous Membrane of the *Fauces*, in the middle of which 'tis joined with its Partner.

These acting draw the *Fauces* upwards, and dilate them in order to receive the maſticated Aliment in *Deglutition*.

LVII.

Tab. xxviii. xxix.

Oesophagæus, *ſeu* Sphincter Gulæ.

ARISES with various Courſes of fleſhy Fibres from moſt of the neighbouring Parts, as is particularly expreſs'd in Tab. xxviii. xxix. and is inſerted into the lateral and back Parts of the *Gula*.

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* *Animadv. in Spigel. & Veſling.* † *Obſerv. Anatom.* ‡ *Hiſtor. Anatom. lib. 5. cap. 9.*

Its

ITS Uſe is to thruſt the maſticated Aliment, by its Compreſſion, through the *Gula* towards the Stomach.

LVIII.

VAGINALIS GULÆ.

Ibid.

STENO ſuppoſes this to conſiſt of a double Order of ſpiral Fibres mutually intercuſſating each other. Dr. *Willis* * ſays the whole *Oeſophagus* ſeems to conſiſt of two Muſcles, which make four Parallelograms with their oppoſite Fibres decuſſating each other. But in Man we find it far otherwiſe, in whom the Fibres of this Muſcle are longitudinal, and oblique; the former ſeem to take their Original at the Arytænoidal Cartilages, and paſſing ſomewhat obliquely to the back part of the *Oeſophagus*, deſcend to the Stomach. The latter ſeem to be a Continuation of the *laſt treated of Muſcles*, deſcending obliquely in a ſpiral manner not unlike thoſe of the Inteſtines.

* *Pharma. Rational. cap.* 2. *Sect.* 2.

CHAP. XVII.
Of the MUSCLES *of the* LARYNX.

THESE Muſcles of the *Larynx* are generally divided into *Common* and *Proper.*

THE *Common* ariſe from other Parts, and are inſerted into the *Larynx,* concerning which *Galen* and the ancient Anatomiſts erred in their Accounts, reckoning three Pair, of which the *Oeſophagæus* is eſteemed as one pair of Muſcles. But this Miſtake is corrected by * *Fabritius ab Aquapendente*, the *Oeſophagæus* being but one ſingle Muſcle, and belonging to the *Gula,* wherefore the common Muſcles of the *Larynx* are reckon'd to be two Pair only; *(viz.) Par Sternothyroideum* and *Hyothyroideum.*

THE *Proper* Muſcles of this Part are ſuch whoſe Riſe and Termination are confined to the Cartilages themſelves. † *Falloppius* and *Placentinus* have both employ'd themſelves in their Deſcription. Theſe are four Pair, beſides one ſingle Muſcle, *(viz.) Par Cricothyroideum, Cricoarytænoideum poſticum, Cricoarytænoideum laterale, Thyroarytænoideum,* and the *Arytænoideus.*

N. B. That all theſe Muſcles of the *Larynx* have their Denominations from their Originations and Inſertions.

LIX.
STERNOTHYROIDEUS.

Tab. XXIV. XXVIII. *Fig.* III. *Tab.* XXX. *Fig.* I.

THIS ariſes broad and fleſhy from the upper and internal Part of the *Sternum,* whence aſcending on the Sides of the Wind-pipe over the *Glandula Thyroidea,* it's inſerted into the whole length of the Thyroidal or Scutiformal Cartilage from its Baſis to its upper Proceſs. This with its Partner pulls the *Larynx* downwards, and lengthens the *Canalis* or Diſtance between the *Rimula,* and Tip of the Tongue, (which latter we take to be the true *Plectrum Vocis)* whereby the Tone of the Voice is render'd grave.

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* *De Lar. cap.* 8. † *Obſervat. Anatom.*

LX.

HYOTHYROIDEUS.

Ibid.

THIS arifes flefhy from the inferiour Part of the *Os Hyoides* laterally, oppofite to the Origination of the *Ceratogloffus*, and defcends directly to the Side of the Scutiformal Cartilage, near the Implantation of the former.

THIS with its Fellow draw the *Larynx* upwards in an acute Tone of the Voice; the Canal of the *Afpera Arteria* being alfo ftraitned thereby.

WE proceed next to the *Proper* Mufcles of the *Larynx*.

IN order to the Adminiftration of thefe, the Mufculus Œfophagæus *muft be freed from both fides the Scutiformal Cartilage; the Arytænoidal Cartilages clear'd from the* Glottis, *and the* Afpera Arteria *feparated from the* Gula.

LXI.

CRICOTHYROIDEUS.

Tab. XXVIII. *Fig.* III. *Tab.* XXX. *Fig.* I. II. III.

THIS is feated on the fore part of the *Larynx*, and is a fhort thin flefhy Mufcle, with a double order of Fibres decuffating each other, arifing from the fore part of the *Cricoides*, whence marching obliquely, it is foon inferted into the *Scutiformis* internally and laterally.

THIS by * *Galen* and † *Vefalius* is made two Mufcles; but in feparating the inferiour Proceffes of the Scutiformal Cartilage from the *Annularis*, you will find but one on each Side, fays ‡ *Fabritius ab Aquapendente*: The Origination and Infertion of which is fuppofed by fome to be *e contrario*, and that its Ufe is rather to pull up the *Annularis*, than to bring down the *Scutiformis* nearer it; but this Controverfy (we think) is of no moment, fince all Mufcles move the Parts lefs ftable to thofe more fix'd.

LXII.

CRICOARYTÆNOIDEUS POSTICUS.

Tab. XXX. *Fig.* II. III. IV. V.

ARISES from the pofteriour part of the Annular Cartilage, filling a fhallow Depreffion of it, with Fibres afcending obliquely outwards, to their Infertion at the lowermoft part of the Arytænoidal Cartilage.

THIS with its Partner ferve for the opening of the *Rimula*; which will plainly appear, if with your Knife you reprefs this Mufcle, the Arytænoidal Cartilage being opened thereby.

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* *De Mufc.* † *Lib.* 2. *Cap.* 21. ‡ *Fabrit. de Laryn. c.* 8.

LXIII.

Ibid. Fig. III. IV. V.

Cricoarytænoideus Lateralis.

This is the ſmalleſt Muſcle of the *Larynx*. It ariſes from the *Cartilago Cricoides* laterally, and aſcending obliquely, is inſerted into the Arytænoidal Cartilage near the Implantation of the former.

This pulls the *Arytænoides* ſideways, and thereby opens the *Rimula*.

LXIV.

Ibid.

Thyroarytænoideus.

This is the largeſt of all the proper Muſcles of the *Larynx*. It has a broad, diſgregated, fleſhy Original from the internal and concave Part of the Scutiformal Cartilage, whence it paſſes with a double Order of Fibres, which decuſſate each other near their Inſertion, to the Arytænoidal Cartilage.

Its Uſe is to draw the Arytænoidal Cartilages nearer to each other, and ſhut the *Rimula*.

LXV.

Ibid. Fig. II. III. IV. V.

Arytænoideus.

This Muſcle has no Partner. It ariſes from the external part of one of the Arytænoidal Cartilages, and running tranſverſly is inſerted into the other.

This pulls the Arytænoidal Cartilages cloſe together, and entirely ſhuts the *Rimula*.

N. B. *Now all the Muſcles of the Lower Jaw may be diſſected; its Depreſſors being left at their reſpective Originations and Inſertions, as before.*

CHAP. XVIII.

Of the MUSCLES *of the* LOWER JAW.

FIVE Pair of Muſcles are employ'd in the Motion of the Lower Jaw: Four of which were deſcribed by * *Veſalius* and the preceding Anatomiſts; but for the Diſcovery of the fifth we are oblig'd to *Falloppius*. To theſe *Riolan* adds a ſixth Pair, namely, the *Quadrati Genarum*, which we have already deſcribed among the Muſcles of the Cheeks and Lips.

LXVI.

TEMPORALIS, *ſeu* CROTAPHITES. *Tab.* XXIII. XXIV. XXXI.

THIS has a large, ſemicircular, fleſhy Beginning, from part of the *Os Frontis*, *Sincipitis*, *Sphenoides*, and *Temporale*. From theſe Places its Fibres paſs (like Lines drawn from a Circumference to a Center) under the *Os Jugale*, from which alſo ariſe ſome fleſhy Fibres joining with the former at their united, partly tendinous and partly fleſhy Inſertion, into the upper part of the *Proceſſus Corone* of the Lower Jaw.

THIS with its Partner draws the Lower Jaw upwards. We could never obſerve thoſe dreadful Symptoms Authors tells us of in Wounds of this Muſcle, though part of it has been taken away to apply the *Trepan* in Fractures of the *Cranium*.

A VERY remarkable Inſtance of which we have in an old Woman now living in *Little Chelſea*; who had not leſs than two thirds of this Muſcle above the *Os Jugale* cut away, in order to remove the pieces of broken Scull underneath it, by which the *Dura Mater* was laid bare two Inches one way, and not leſs than an Inch and half the other. This Woman recover'd under the Care of Mr. *Tooly*, an experienc'd Surgeon in *Chelſea*, and my ſelf.

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* *Lib.* 2. *Cap.* 15.

LXVII.

Tab. XXIII. XXXI.

MASSETER.

IS a ſhort, thick Muſcle, partly fleſhy, and partly tendinous. It ariſes forwards from the firſt Bone of the upper Jaw, backwards from the *Os Jugale*, and ſome of its Fibres are continued from the *Temporalis* under the laſt named Bone. Thence deſcending with Fibres interſecting each other in acute Angles, it is inſerted into the lower and external part of the under Jaw-Bone.

THIS aſſiſts the former in its Office. The paſſing of the *Ductus Salivalis Superior* over this Muſcle is a provident contrivance of Nature, to preſs out the *Saliva* in Maſtication. The next Muſcle which preſents it ſelf is the *Digaſtricus*, by ſome call'd *Graphoideus*, becauſe they imagine it to ariſe from the Styloidal Proceſs.

LXVIII.

Tab. XXIII. XXXI.

DIGASTRICUS, *ſeu* BIVENTER.

SO called from its Figure, it being compoſed of two Bellies. It ariſes fleſhy from a *Sulcus* near the internal and back part of the *Proceſſus Maſtoides*, under part of the *Complexus*; whence deſcending, it becomes tendinous, paſſing through the *Stylohyoideus*, and an annular Ligament, or ſometimes a membranous Incloſure, laterally faſtned to the *Os Hyoides*; to which Bone it is likewiſe faſtned by ſome tendinous Fibres detached from its middle Tendon. Thence it aſcends to its Inſertion at the middle of the inferiour part of the Lower Jaw. The paſſage of the middle Tendon of this Muſcle through the Annular Ligament fix'd to the *Os Hyoides*, like a Rope through a Pully, is a wonderful contrivance of the Author of Nature to render it capable of pulling down the Lower Jaw, which, had its Progreſs been direct from its Origination, could not have been perform'd. Nor are there any Proceſſes, whether of the *Vertebræ* of the Neck, or the neighbouring Parts, that could give an Origination to theſe Muſcles, below their Inſertions, as in ſome *Quadrupeds:* Wherefore the Divine Architect of human Bodies has placed theſe Pullies below the Terminations of theſe Muſcles, whereby they are enabled to pull down the Lower Jaw and open the Mouth. The Pullies being fix'd to the *Os Hyoides*, the Action of theſe Muſcles is neceſſarily interrupted in Deglutition, becauſe the Tongue, *Larynx*, and the *Os Hyoides*, are all rais'd upwards in ſwallowing, and conſequently, at that time, the Digaſtrick Muſcles cannot act. Hence it is, that, when we ſwallow our Aliment, the under Jaw is drawn towards the upper, and the Mouth is ſhut. But in Dogs, and perhaps in other voracious Animals, where theſe Muſcles paſs directly from their Origines to their Inſertions, theſe two Actions of depreſſing the Lower Jaw, and raiſing the *Os Hyoides*, do not interfere with each other, which may be one reaſon why theſe Creatures devour their Food ſo ſpeedily.

LXIX.

LXIX.

PTERYGOIDEUS INTERNUS.

Tab. XXXI.

SO called from its Origine and Situation. It arifes partly tendinous, and partly flefhy, from the *Proceffus Pterygoides*, or *Aliformis*, of the *Os Sphenoides*, whence it defcends to its Implantation at the internal and inferiour part of the Lower Jaw, oppofite to the Termination of the *Maffeter*,

EITHER of thefe acting, draws the Jaw to the contrary Side; if both act, they affift the *Temporales* and *Maffeteres*.

IN a Subject I lately diffected I obferved an elegant diftinct Mufcle, tho' very fmall. This arofe flefhy from the extremity of the *Proceffus Styloides*, but foon became tendinous, and was fo inferted immediately above the external lower Angle of the under Jaw, between the Terminations of the *Maffeter* and *Pterygoideus Internus*. *Tab.* XXXI. *E.*

N. B. *To difcover the following Mufcle the* Temporalis *and* Maffeter *on either fide muft be removed. But if you ftill defire a fairer Profpect of it, with a Chiffel cut off part of the* Proceffus Corone, *together with the* Os Jugale.

LXX.

PTERYGOIDEUS EXTERNUS.

Tab. XXIV. XXXI.

THIS, like the former, receives its Name from its Situation and Origine: it arifing from the external Part of the faid *Proceffus Pterygoides*, and fuperiour Part of the *Os Sphenoides* feated in the cavity of the Temples, oppofite to the *Os Jugale*, whence it runs backwards to its Infertion at the Neck of the *Proceffus Condyloides* of the Lower Jaw.

WHEN this and its Partner act, they draw the Lower Jaw forwards, and force the Teeth of the Lower Jaw beyond thofe of the Upper, as *Falloppius* * their firft Defcriber obferves.

* *Obfervat. Anatom.*

Chap. XIX.
Of the MUSCLES *of the* Thorax.

THE Muſcles of the *Thorax* may be divided into *Proper* and *Common.*

The *Proper* Muſcles have their Riſe and Termination within the Limits of the *Thorax*, as the *Intercoſtales*, the *Triangularis*, and the *Serrati Poſtici.*

The *Common* are ſuch Muſcles uſed in moving the *Thorax*, as take either their Origine, or Inſertion, from other Parts. Of theſe ſome are Principal, having their Inſertions in the *Thorax*, and immediately contributing to its Motion, as the three *Scaleni*, the two *Serrati Antici*, the *Subclavius*, Diaphragm, and *Sacrolumbalis*, which laſt we reckon among the Muſcles of the *Thorax*, in compliance with other Anatomiſts, though it might perhaps be more properly placed among thoſe of the Back. Other of the common Muſcles may be called auxiliary, as moving only the neighbouring Parts, whoſe Actions are in ſome degree ſerviceable to the Motion of the *Thorax*, of which ſort are the Muſcles of the *Scapula*. For in extraordinary Inſpirations the Elevation of the *Scapulæ* is neceſſary, ſince the *Serrati Antici* cannot act in raiſing the Ribs without it. Whence an Account may be given, why Reſpiration is leſs free, when the Arms are employ'd in any laborious Action. Thus likewiſe in Aſthma's, Peripneumonies, Pleuriſies, and other Caſes, wherein the Organs of Reſpiration are inflamed, or otherwiſe obſtructed in the due execution of their Office, the Extenſion of the Neck becomes neceſſary, in order to give liberty to the *Scaleni* to aſſiſt in raiſing up the Ribs.

But

But though this Division of the Muscles of the *Thorax* be commodious enough for learning and retaining in memory their several Uses, yet it will be more agreeable to our present Design, to treat of them in such order, as they are most easily rais'd in the course of Dissection. For which reason we shall take leave to divide them into, *such Muscles of the* Thorax *as appear on its fore part, The Muscles of the* Scapula, *and Those Muscles of the* Thorax, *that appear on its back part.*

First then of *those Muscles which appear on the fore part of the Thorax.*

LXXI.

Serratus Minor Anticus.

Tab. II. V. XXXII.

Anatomists generally reckon this Muscle amongst those of the *Scapula*; but we are persuaded from its Position, that it may be equally serviceable to the *Thorax*, in elevating those Ribs it is inserted into. Wherefore we offer it indifferently, whether belonging to one, or the other; but choose to insert it in this place, because it now appears in *Situ*. If due Care be not taken in raising the *Pectoralis*, you will be in danger of wounding this. It arises fleshy from the *Processus Coracoides Scapulæ*, and descends obliquely forwards, becoming broader and thinner, and is inserted fleshy into the Bony Part of the second, third, and fourth Ribs. If the *Scapulæ* are elevated by their proper Muscles, this with its Partner are then capable of dilating the Breast in large Inspirations: But if those are depress'd, it may be easily conceived with what difficulty that Action must then be perform'd.

Ibid.

LXXII.

Serratus Major Anticus.

This arises fleshy from the whole *Basis Scapulæ*, and passing under the *Subscapularis*, it becomes broader and thicker, still running somewhat forwards, till its inserted into the eight superiour Ribs laterally, by so many distinct fleshy Portions, or *Digituli*, representing the Teeth of a Saw; the two and sometimes three inferiour of which are indented with the *Obliquus Descendens* of the *Abdomen*, as was before noted. This like the former dilates the *Thorax*, or moves the *Scapula* forwards and downwards, when its Muscles are relaxed.

The next Muscle of the *Thorax*, that appears as the Body lies supine, is the *Diaphragm*, which is a singular Muscle, elegantly framed for those Uses, for which the Author of Nature has design'd it.

LXXIII.

Tab. II. V. VI. XXXIII.

Subclavius.

Arises fleshy from the inferiour part of half the *Clavicula*, next its connection with the *Spina Scapulæ*; hence its Fibres descend obliquely forwards, and it becomes a round Tendon at its Insertion into the superiour part of the first Rib near the *Sternum*. Its Use is intimated above; but * *Spigelius*, who has written a Chapter expresly about this Muscle, pretends it depresses the *Clavicula*; for which Opinion he argues strenuously, and to this purpose relates an Observation from *Hippocrates*, that when the *Clavicula* is fractured near the *Sternum*, that next part visibly ascends, and that part next the *Scapula*, together with the *Humerus*, falls down; but if its fractur'd near the *Scapula*, then neither part rises; which, as our Author conjectures, seems to depend on the Termination of this Muscle. In the first case, it draws part of the *Clavicula*, together with the *Humerus* downwards, the Fracture being betwixt its Insertion and the contrary end of the Bone, that is fix'd to the *Sternum*. In the latter, the Fracture being made in that part, where this Muscle is inserted, it must keep the ends of the Bone in the same posture, as before the Accident.

LXXIV.

Tab. III. VI. XXXIII.

Scalenus Primus.

This arises fleshy from the fore part of the fourth and fifth, and sometimes likewise from the sixth, transverse Processes of the *Vertebræ* of the Neck, and descending obliquely forwards, becomes tendinous at its insertion into the first Rib. The Axillary Nerves pass between this and the following Muscle.

Its Use is to draw the superiour Rib, together with the rest, upwards in Inspiration.

LXXV.

Tab. III. V. XXXIII.

Scalenus Secundus.

This springs fleshy from the third, fourth and fifth transverse Processes of the *Vertebræ* of the Neck laterally; in its Descent it becomes thin and tendinous, marching, over the first Rib, to its Insertion into the second, and sometimes the third.

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* *Lib.* 4. *Cap.* 9.

LXXVI.

LXXVI.

SCALENUS TERTIUS.

Tab. III. XXXIII.

THIS has its Beginning near the former from the tranſverſe Proceſs of the ſixth *Vertebra* of the Neck, and is ſoon inſerted into the firſt Rib.

THESE three laſt Muſcles are called *Scaleni* from their Figure, having three unequal Sides. Though they are moſt commonly reckon'd among thoſe of the Neck, to whoſe Motion they are ſubſervient, yet the judicious * *Falloppius*, duly conſidering the *Subclavius* and *Serratus Superior Poſticus* to be inſufficient for the Elevation of the Cheſt, aſſigns theſe part of that Office.

THE Sternum *being raiſed, by dividing the Cartilages on each ſide from the Bony Endings of the Ribs, the following Muſcle will appear underneath.*

LXXVII.

TRIANGULARIS.

Ibid.

THIS with its Partner lies on each ſide the *Cartilago Enſiformis*, within the Cavity of the *Thorax* under the *Sternum*; ſometimes it appears to be three, at other times four diſtinct Muſcles on each ſide. It ariſes from the inferiour Part of the *Os Pectoris*, whence its upper part aſcends, and the lower deſcends to its Implantations at the Bony Endings of the fourth, fifth, ſixth, and ſometimes ſeventh and eighth Ribs, near their Conjunctions with their Cartilages.

ITS Uſe is to contract the Breaſt.

THE next Muſcle of the *Thorax*, that appears as the Body lies ſupine, is the *Diaphragm*, which is a ſingular Muſcle, elegantly framed for thoſe Uſes, for which the Author of Nature has deſign'd it.

LXXVIII.

DIAPHRAGMA.

Tab. XXXIV. XXXV.

† S*TENO* ſuppoſes this to be a Digaſtric Muſcle. ‡ *Caſpar Bartholin* conceiving it double, calls the lower Part, ſpringing from the *Vertebræ* of the Back and Loins, the *Muſculus Inferior*, and the oppoſite ariſing from the Cartilaginous Endings of the Ribs, the *Superior*; or imagines it Trigaſtrical, as above noted, *Chap.* I. Which latter Opinion of his ſeems to quadrate to this Part in Birds. But whether we may ſuppoſe it one or two Muſcles in Man, is a Matter more of Controverſy than uſe. Its inferiour part ariſes partly tendinous and partly fleſhy on the Right Side, from the firſt, ſecond, and third *Vertebræ* of the Loins; on the Left from the laſt, and laſt but one of the Back: Hence it aſcends with fleſhy Fibres, which run ſtreight on each ſide, but in the middle paſs ſomewhat curvedly,

* *Obſerv. Anatom.* † *Specim. Myologiæ.* ‡ *Diaphr. Structur. cap.* 2.

and interſecting each other, do as it were embrace the *Oeſophagus*; after which they become tendinous, and join with its upper part, which ariſes thin and Membranous, but ſoon growing fleſhy, from the whole inferiour Margin of the cartilaginous endings of the Ribs, and lower part of the *Os Pectoris*; whence, its fleſhy Fibres, like Lines drawn from a Circumference towards a Center, paſs to its middle part, where its tendinous Fibres intercuſſate each other, and exhibit a *Rete*. It has two large Perforations, the one in its tendinous part, to tranſmit the *Vena Cava* towards the right Auricle of the Heart; the other in its fleſhy part, which, like an *Annulus*, embraces the *Oeſophagus*, (as above noted). Its double Origine at the *Vertebræ* gives way to the deſcending Trunk of the *Arteria Magna*, and two aſcending of the *Ductus Chyliferus* and *Vena Azygos*.

ITS Uſe in the Animal Œconomy is too large to be inſerted in this place. *Pecquet* obſerves, that when all the Muſcles of Reſpiration are ſeparated and removed, the *Diaphragma* and *Intercoſtales* excepted, the Animal ſtill perſiſts to breathe. When we inſpire, its ſuperiour Surface comes towards a Plain. In Expiration it's convex towards the *Thorax*, and concave towards the *Abdomen*. In the former the *Viſcera* of the lower Belly are compreſs'd, and the Cavity of the *Thorax* enlarged. In the latter the Air is expreſs'd out of the *Veſiculæ* of the Lungs.

THE Thorax *being now laid open, the Heart and Lungs may be taken out. After which you may raiſe the* Pleura, *beginning at the Diviſion of the Ribs from their cartilaginous Endings, which were left at the* Sternum; *where thruſting in your Fingers between that Membrane and the internal Intercoſtal Muſcles, you may clear it away to the* Vertebræ *of the Back. By which means you will have a clear View of the* Series *of Fibres of thoſe Muſcles.*

LXXIX.

Tab. III. XXXIII.

INTERCOSTALES INTERNI.

ARE in number eleven on each ſide, ariſing from the upper edge of each inferiour Rib, and inſerted into the lower edge of that immediately above it, the Courſe of their Fibres aſcending obliquely forwards. But we have obſerv'd, that ſome Parts of theſe Muſcles lying next the *Vertebræ*, paſs over the Rib immediately above their Origine, and are inſerted into the next, as repreſented in Tab. XXXIII. Fig. II. *AB*, *AB*.

THESE ſeem to depreſs the Ribs.

LXXX.

LXXX.
COR.

Tab. XXXVI. XXXVII. XXXVIII. XXXIX. XL.

WE have been ſo large in the Repreſentation of the ſeveral Parts of this Muſcle in five Copper Plates, and in the Deſcription of them in the References thereto belonging, that we think it ſuperfluous to ſay any more of it in this Place.

N. B. *To proſecute our Work, we muſt now lay the Subject in a prone Poſition the Back uppermoſt, continuing our Section from the* Occiput *down to the* Os Sacrum, *and interſecting it with a tranſverſe Line over the* Regio Lumbalis. *Which done, and the common Integuments removed, the ſubjacent Muſcles may be beſt diſſected in the following Order.*

CHAP. XX.

Of the MUSCLES *of the* SCAPULA, *or* SHOULDER-BLADE.

THESE Muſcles make the ſecond Diviſion of thoſe relating to the Motion of the *Thorax*, as above-ſaid.

LXXXI.

Tab. VII. XLII.

CUCULLARIS, *ſeu* TRAPEZIUS.

SO named, becauſe this with its Fellow covering the Back repreſents a Cowl. It ariſes fleſhy from the *Os Occipitis*, tendinous from the *Ligamentum Colli*, and *Apex* of the Spine of the laſt *Vertebra* of the Neck, and eight ſuperiour of the *Thorax*; from which broad Origination becoming thick and fleſhy, it's ſo inſerted into the *Clavicula*, but is moſtly tendinous at its Inſertion into the *Spina Scapulæ*. Each Muſcle is triangular, and both jointly compoſe a Lozenge or *Trapezium*, whoſe large Diameter extends from the *Occiput* to the fifteenth *Vertebra*; the ſhorter from near the Extremity of the *Spina Scapulæ* on one ſide to that of the other. They contain a triple Series of Fibres; the middle paſſing directly tranſverſe from the firſt *Vertebra* of the *Thorax*; thoſe above deſcend, and thoſe beneath aſcend to their Inſertion; whereby the *Scapula* is variouſly moved according to their Directions, either obliquely upward, directly back, or obliquely downwards.

N. B. *You muſt proceed with Caution in the ſeparation of this Muſcle, leſt you raiſe the following with it, which adheres very ſtrictly to its tendinous Part, where it ſprings from the ſuperiour Spines of the* Vertebræ Thoracis.

LXXXII.

XLI. XLII.

RHOMBOIDES.

SO called from its Figure. This lies immediately under the former: In ſome Subjects we have found it divided into two diſtinct Muſcles on each ſide. It ariſes tendinous from the *Ligamentum Colli*, the Spines of the loweſt *Vertebra* of the

the Neck, and four uppermoſt of the *Thorax*; whence deſcending obliquely, it becomes thick and fleſhy, and is ſo inſerted into that part of the *Baſis Scapulæ* that lies below its Spine.

WHEN this acts, it draws the *Scapula* upwards and backwards.

N. B. *THIS adheres ſtrictly to its ſubjacent Muſcle the* Serratus Superior Poſticus; *wherefore you muſt be cautious in raiſing it.*

LXXXIII.

LEVATOR SCAPULÆ.

Ibid.

BY ſome called *Levator Patientiæ*. This lies immediately under the *Cucullaris*, ariſing by ſo many ſeparate Originations from the firſt, ſecond, third, and fourth tranſverſe Proceſſes of the *Vertebræ* of the Neck. Theſe unite into one large fleſhy Body, which deſcends obliquely to its Inſertion into the ſuperiour Angle and the next part of the *Baſis* of the *Scapula.*

WE have found in ſome Subjects a few Slips of fleſhy Fibres ſent off from this Muſcle at its lower Part, and ending tendinous on the ſecond, or third Rib, with the upper Part of the *Serratus Major Anticus.*

ITS Name declares its Office.

N. B. *WE proceed next to the Muſcles of the* Thorax *which appear on the Backſide, the Body lying prone; to diſcover which, the* Latiſſimus Dorſi *muſt be removed, part of it being raiſed in the* Ilia *in diſſecting the Muſcles of the* Abdomen, *where you muſt purſue its Separation, firſt cutting it from the poſteriour Part of the Spine of the* Ilium, *ſeparating it (if poſſible) from the* Serratus Inferior Poſticus; *freeing it from the Spines of the Loins, and inferiour of the* Thorax, *and leaving it at its Inſertion into the* Os Humeri. *This done on both ſides, the reſt of the Muſcles of Reſpiration offer themſelves.*

CHAP. XXI.

Of the MUSCLES *of the* THORAX, *which appear on the backside of the Body.*

THESE constitute the third Order of Muscles belonging to the *Thorax*.

LXXXIV.

Tab. XLI. XLII.

SERRATUS SUPERIOR POSTICUS.

THIS lies immediately under the *Rhomboides*, as above noted. It arises with a thin Tendon from the *Ligamentum Colli* the Spine of the lowest *Vertebra* of the Neck, and three superiour of the *Thorax*; from thence descending obliquely over the *Splenius Capitis*, and upper Parts of the *Sacrolumbalis*, and *Dorsi Longissimus*, it becomes fleshy, marching under the *Scapula* to its Insertion at the Curvature of the second, third, fourth, fifth, and sometimes sixth Ribs, by so many distinct fleshy Endings.

THIS assists in elevating the Ribs.

LXXXV.

Ibid.

SERRATUS INFERIOR POSTICUS.

THE Origination of this Muscle is much larger than Authors generally assign it. In a robust Subject we observed its Continuation not only from the Spines of the *Vertebræ* of the Loins, but from all those of the *Thorax*, as well underneath as below the former Muscle; its superiour and inferiour Parts being entirely tendinous, its middle growing fleshy near its serrated Terminations at the Curvature of the tenth, eleventh, and Extremity of the twelfth Ribs. The *Ductus* of Fibres of this passing transverse, and those of the precedent descending obliquely, do decussate each other in acute Angles; which * *Riolan* has well observed, and

* *Anthrop. Lib.* 5.

contrary

contrary to the Opinion of other Authors, aſſigns this Muſcle with its Partner a different Uſe, in depreſſing the *Thorax*; both performing the Office of a Bandage in binding together and conſtringing the poſteriour Muſcles of the Spine, not unlike thoſe conſtrictive Incloſures of the Thigh and Cubit hereafter mentioned.

LXXXVI.

SACROLUMBALIS.

Tab. VIII. IX. XLV.

THIS riſes in common with the *Longiſſimus Dorſi*, externally tendinous, and internally fleſhy, from the hinder part of the Spine of the *Os Ilium*, the upper Part of the *Sacrum*, and all the Spines of the *Vertebræ* of the Loins. Whence aſcending with a direct Order of Fibres, they are inſerted, by ſeveral common Terminations, into the tranſverſe Proceſſes of the *Vertebræ* of the Loins, before their Diviſion into two ſeparate fleſhy Bodies, at their Paſſage over the lowermoſt Rib; the outermoſt of which is called *Sacrolumbalis*. This is inſerted into the twelve Ribs, near the beginning of their Curvature, by ſo many thin, long Tendons. It receives a *Faſciculus* of tendinous and fleſhy Fibres from each of the nine, or ten, lower Ribs; which after their uniting with the Body of the Muſcle, are continued to the Tendons above-mention'd, that are inſerted into the upper Ribs. Theſe *Faſciculi* are call'd by *Steno**, *Muſculi ad Sacrolumbum acceſſorii*. The upper Part of this Muſcle, after it has paſt the *Thorax*, is inſerted by four Tendons into the third, fourth, fifth, and ſixth *Vertebræ* of the Neck; which Part is by *Diemerbroek* † made a diſtinct Muſcle, and called *Cervicalis Deſcendens*.

LXXXVII.

INTERCOSTALES EXTERNI.

Tab. XLIV. XLVI.

ARE equal in number to the Internal. They ariſe from the lower Edges of the upper Ribs, and deſcending obliquely forwards are inſerted into the upper Edge of the Rib next below, their Fibres decuſſating thoſe of the internal Intercoſtals. The *Levatores Coſtarum*, ariſing from the tranſverſe Proceſſes of the *Vertebræ* of the Back, and inſerted into the upper Edge of each Rib, except the firſt, we eſteem as parts of theſe external Intercoſtals.

NOW all the Muſcles of the Head may be examined.

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* *Specim. Myolog.* † *Lib. 5. Cap. 6.*

Chap. XXII.
Of the MUSCLES *of the* Head.

THE Head is moved by Muſcles that are either *Common* or *Proper*.

The *Common* are thoſe, which move the Head together with the *Vertebræ* of the Neck, which ſhall be deſcribed in the following Chapter, under the Title *of the Muſcles of the Neck*.

The *Proper* are thoſe, which move the Head together with the firſt *Vertebra* of the Neck only, the reſt remaining unmoved; of which latter Anatomiſts, as * *Spigelius*, † *Veſlingius*, and others reckon eight pair, *viz.* *Maſtoidei*, *Splenii*, *Complexi*, *Par tertium Falloppii*, *Recti Majores*, *Recti Minores*, *Obliqui Superiores* & *Obliqui Inferiores*: But ‡ *Oribaſius* adds two pair more, who is followed by ** *Falloppius*, which ſhall be deſcribed here, as they ariſe in Diſſection, together with another pair of Muſcles, not mentioned by any Author, (for what I know,) but firſt obſerved by me ſome time ſince.

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* *Lib.* 4. † *Cap.* 12. ‡ *Lib. De Diſſect. Muſcul. ex Galeno, Cap.* 10. ** *Obſerv. Anatom.*

LXXXVIII.

SPLENIUS.

Tab. XLI. XLIII.

ARISETH partly tendinous and partly fleshy, from the four superiour Spines of the *Vertebræ* of the *Thorax*; and this lower Part seems to be distinct from the upper, which ariseth from the Spines of the two inferiour *Vertebræ* of the Neck only. The lower Part ascending obliquely grows fleshy, and becomes tendinous again at its Insertion into the first, second, and some times third, transverse Processes of the *Vertebræ* of the Neck: The upper part of the Muscle in like manner ascending obliquely outward, grows fleshy, and is so inserted into the *Occiput*, partly under the Implantation of the *Mastoideus*. Although this Muscle by Anatomists be reckoned amongst the proper Muscles of the Head, yet when it acteth it must necessarily move the first, and second *Vertebræ* of the Neck (into which it is inserted) obliquely backwards; but acting with its Partner, it pulleth those *Vertebræ* together with the Head directly backwards.

LXXXIX.

COMPLEXUS.

Tab. IX. XLIII.

RISES fleshy from the transverse Processes of the six upper *Vertebræ* of the *Thorax*, partly tendinous and partly fleshy from those of the six lower *Vertebræ* of the Neck; after which becoming fleshy, and partly tendinous on the outside, it is inserted broad and fleshy into the *Os Occipitis*. That part of this Muscle, that springs from the tranverse Processes of the *Thorax*, joins with the *Longissimus Dorsi*. The Fibres of this Muscle are rightly observed to decussate those of the former. *Falloppius* makes a part of the *Longissimus Dorsi*, that passes over the *Complexus*, a distinct Muscle, which he calls the third Muscle of the Head. This is more distinct in some Bodies, than in others.

EITHER of the *Complexi* acting moves the Head backwards to one side: If both act together, they assist the two former. This with its Partner being raised, the four following Muscles appear underneath.

XC.

Tab. VI. Fig. IV. Tab. XLIII.

Rectus Major.

This ariſeth partly tendinous, but chiefly fleſhy from the ſuperiour part of the double Spine of the ſecond *Vertebra* of the Neck, and in its aſcent becomes broader and fleſhy, and is ſo inſerted into the hinder part of the *Os Occipitis*, partly under the Termination of the *Obliquus Superior*.

This Muſcle with its Partner acting, pull the Head directly back on the firſt *Vertebra*. Theſe being both raiſed, the following Muſcle will appear underneath.

XCI.

Ibid. and *Tab.* XLIV. M.

Rectus Minor.

These are two ſmall Muſcles, appearing in ſome Subjects before the former are diſſected. They ariſe fleſhy from the poſteriour part of the firſt *Vertebra* of the Neck, and are ſo inſerted into the middle part of the *Os Occipitis*, in two ſhallow Depreſſions of the ſaid Bone.

These from their Uſe may be called *Renuentes*, or Nodders backwards, and are Antagoniſts to thoſe we ſhall hereafter deſcribe, and call *Annuentes*.

XCII.

Ibid.

Obliquus Superior.

This ariſing fleſhy from the back part of the tranſverſe Proceſs of the firſt *Vertebra* of the Neck, in its ſomewhat oblique Aſcent becometh a fleſhy Belly, and leſſening it ſelf again, is inſerted into the *Os Occipitis* laterally.

By this, together with its Partner, (they never acting ſeparately) the Head is moved backwards on the firſt *Vertebra*.

XCIII.

Ibid.

Obliquus Inferior.

This ariſeth fleſhy from the external part of the Spinal Proceſs of the ſecond *Vertebra* of the Neck, cloſe by the Origination of the *Rectus Major*, and being dilated into a fleſhy Belly, paſſes obliquely to its Inſertion at the tranſverſe Proceſs of the firſt *Vertebra*, where the former Muſcle begins. When this acts on either ſide the tranſverſe Proceſs of the firſt *Vertebra* of the Neck is moved towards the Spine of the ſecond; wherefore ſome Authors have reckoned it amongſt the Muſcles of the Neck. But ſince the Head is alſo moved thereby, and the Face turned to that ſide on which it acteth, it is not improperly reckoned amongſt the Muſcles that move the Head. It is aſſiſted by the *Maſtoideus*; of which in its Order.

The

The four Muſcles laſt treated of are named from their Progreſs, Poſition, and Magnitude.

The Body muſt now be turned on the Back again, to examine the reſt of the Muſcles of the Head that appear on the fore part, together with thoſe of the Neck, of which the firſt is the Maſtoideus, *which is beſt raiſed, by freeing it at its Origination on one ſide, and its Inſertion on the other, as in* Chap. XII. *in order to diſſect the Muſcles of the* Os Hyoides *and the Tongue.*

XCIV.

Mastoideus.

Tab. vxxii. xliii.

So called, becauſe it is inſerted into the Mamillary Proceſs of the Temple-Bone. It ariſeth partly tendinous, and partly fleſhy, from the upper part of the *Os Pectoris*, and near half the Clavicle, with two (as it were) diſtinct Originations; the firſt of which aſcending ſomewhat obliquely outwards joins with the ſecond, and afterwards marches up more directly, compoſing a round, thick, fleſhy Body, which, as it paſſeth over the upper part of the *Muſculus Levator Scapulæ*, becomes broader and tendinous, and is ſo inſerted into the back part of the *Proceſſus Mamillaris*, and the adjoining part of the *Os Occipitis*, where the *Splenius* (above treated of) is implanted.

These Muſcles contracting together bend the Head forwards; but either of them acting alone draws it down to one Side.

The next Muſcle that preſents it ſelf to the Knife, is partly deſcribed by * *Galen*, and mentioned by † *Veſalius* as belonging to the Back: ‡ *Falloppius* makes it his ninth Pair of the Head. It is alſo mentioned by *Riolan*, *Caſp. Bauhin*, *Bartholomæus Euſtachius*, and others. Tho' it be a large fleſhy Muſcle, and appear immediately under the *Gula* or *Pharynx*, yet *Spigelius* and ſome others take no notice of it. It is likewiſe expreſs'd by *Bidloo*, and called *Rectus Internus*. But we having obſerved an other ſmall pair of Muſcles underneath this pair, of a right Poſition likewiſe, we ſhall call them, for diſtinction, *Recti Interni Minores*, and theſe, *Recti Interni Majores*.

XCV.

Rectus Internus Major.

Tab. iii. xliii.

This has commonly four Beginnings, partly tendinous, but chiefly fleſhy, from the fore part of the four lowermoſt tranſverſe Proceſſes of the *Vertebræ* of the Neck; (but in ſome Subjects we have found its Origination to extend much lower down, even as far as the fourth *Vertebra* of the *Thorax*,) and in its

* *Lib. de Muſculis.* † *Lib.* 2. *cap.* 28. ‡ *Obſerv. Anatom.*

aſcent

aſcent becoming fleſhy, paſſes over the three ſuperiour *Vertebræ*, and is inſerted into the anteriour *Appendix* of the *Os Occipitis*, near the great *Foramen*, that tranſmits the *Medulla Oblongata*.

THIS manifeſty bends the Head forewards, and therefore may be called *Flexor Capitis* from its Uſe.

THIS with its Partner being removed, the following pair of Muſcles appear underneath them.

XCVI.

Tab. XXIV. XLIII.

RECTUS INTERNUS MINOR.

THIS and its Partner appear on the fore part of the firſt *Vertebra*, like the *Recti Minores* on the back part, ariſing near its tranſverſe Proceſſes, whence they aſcend directly, and are inſerted into the anteriour *Appendix* of the *Os Occipitis*, immediately under the former.

THESE nod the Head forward, and are Antagoniſts to the *Recti Minores*, as is above noted, wherefore they may be called *Annuentes*.

THE laſt pair of Muſcles which we ſhall treat of belonging to the Head, are mentioned by *Galen*, and deſcribed by * *Falloppius* in theſe Words; *Ultimo loco notandi ſunt Muſculi duo admodum parvi, qui à Proceſſu tranſverſo Primæ Vertebræ orti, valde graciles aſcendunt ad Caput, & in illud inſeruntur prope Mamillarem proceſſum.* Theſe we ſhall call *Recti Laterales*, from their Progreſs and Poſition; they may be alſo called *Renuentes Laterales* from their Uſe.

XCVII.

Ibid. and *Tab.* XLIV. N.

RECTUS LATERALIS.

THIS is a ſhort, thick, fleſhy Muſcle; ariſing from the ſuperiour part of the Extremity of the tranſverſe Proceſs of the firſt *Vertebra* of the Neck, between the former and *Obliquus Superior*, whence it aſcends directly to its Inſertion into the *Os Occipitis*, in the Interſtice made by the *Proceſſus Mamillaris* and *Styloides*. This nods the Head to one Side.

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* *Obſervat. Anatom.*

CHAP.

CHAP. XXIII.
Of the MUSCLES *of the* NECK.

THE Muſcles of the Neck move the Head ſecondarily, whence they are eſteemed as *Common* to both. Of theſe Authors reckon four pair, namely the *Longi Colli*, the *Scaleni*, (which according to *Falloppius* are deſcribed amongſt the Muſcles of the *Thorax*) the *Tranſverſales*, and *Spinati Colli*.

XCVIII.
LONGUS COLLI. *Tab.* III. XLIV.

THIS ariſes partly tendinous, but chiefly fleſhy from the fore part of the three ſuperiour *Vertebræ* of the *Thorax*, and three lowermoſt of the Neck; and being dilated in its middle to a fleſhy Belly, is inſerted into the fore part of all the reſt of the *Vertebræ* of the Neck.

THIS with its Partner acting bends the Neck right forwards. Between this and the *Scaleni*, (deſcrib'd *Chap.* XIX.) lies the *Rectus Internus Major*, deſcrib'd in the precedent Chapter, which * *Veſlingius* calls *Muſculus Brevior*.

XCIX.
SPINALIS COLLI. *Tab.* XLIV.

SO called, becauſe it accompanies the Spines of the Neck. It ariſes tendinous and fleſhy from the tranſverſe Proceſſes of the five upper *Vertebræ* of the *Thorax*, and the lowermoſt of the Neck. In its Aſcent it becomes more fleſhy, and has a large fleſhy Inſertion into the inferiour part of the ſecond *Vertebra* of the Neck laterally, near its Spinal Proceſs. Internally it ſends off three Tendons, which terminate in the Sides of the double Spines of the third, fourth, and fifth *Vertebræ* of the Neck.

THESE draw the Neck backwards; or a little to one Side, when they act ſeparately.

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* *Cap.* II.

C.

Tab. xliv. xlvi.

Interspinales Colli.

These are ſmall fleſhy Muſcles, ariſing from the ſuperiour Part of each double Spinal Proceſs of the Neck, except that of the ſecond *Vertebra*, and are inſerted into the inferiour part of the double Spines immediately above them.

When theſe Muſcles act, they draw the Spines of the *Vertebræ* of the Neck nearer each other. Theſe we firſt diſcover'd in the Year 1690.

CI.

Tab. xlv. xlvi.

Transversalis Colli.

This ariſeth fleſhy from all the tranſverſe Proceſſes of the *Vertebræ* of the Neck, except the firſt and ſecond, and is inſerted, after an oblique aſcending Progreſs, into their ſuperiour Spines: It being a Continuation of the ſame Series of Muſcular *Fibres* that compoſe the *Sacer* and *Semi-Spinatus*; of which hereafter.

This Muſcle detaches off two ſeveral Productions, the ſhorter of which is inſerted into the *Os Occipitale*, near the Maſtoide Proceſs; the longer and ſlenderer *Tab.* xxiii. is likewiſe implanted in the *Os Occipitis*, beſide the Production of the *Longiſſimus Dorſi*, called, *Par tertium Falloppii.*

This pair of Muſcles acting together, help to keep the Neck erect; but either of them acting alone, draws the *Vertebræ* of the Neck obliquely backward, by which Motion the Head is turned towards the contrary Shoulder.

Tab. xxiii. xliv. The *Intertranſverſales* are ſmall Muſcles, ariſing from each tranſverſe Proceſs of the *Vertebræ* of the Neck, except the firſt, and inſerted into the tranſverſe Proceſs immediately above.

Chap.

CHAP. XXIV.

Of the MUSCLES *of the* BACK *and* LOINS.

IT would be very tedious and of little Uſe to inſert all the different Accounts Anatomiſts have given us of theſe Muſcles; and the variety we have found in ſeveral Subjects, inclines us to think, that ſcarcely three in ten are exactly alike in this reſpect. Which Irregularity might perhaps induce *Falloppius* to that ingenuous Confeſſion, that theſe Muſcles ſeemed to him to be an indigeſted Heap and confuſed *Chaos*. However, we ſhall endeavour to give as diſtinct an Account of them as poſſible; and in order thereunto, we ſhall conſider them as *Common* to the Back and Loins, or *Proper* to either of them.

THE *Common* are ſuch as ariſe from the one, and are inſerted into the other, as the *Dorſi Longiſſimi.*

THE *Proper* are either ſuch, as ariſe from the *Os Sacrum* or *Ilium*, and are inſerted into the *Vertebræ* of the Loins only, as the *Quadrati Lumborum*; or ariſe from the tranſverſe Proceſſes either of the *Vertebræ* of the Loins or *Thorax*, and are inſerted into their ſuperiour Spines; as the *Tranſverſales Vertebrarum Dorſi & Lumborum*, which by Authors are commonly called *Sacer* and *Semiſpinatus*.

CII.

LONGISSIMUS DORSI.

Tab. VIII. IX. XLV.

THIS Muſcle takes its Origine in common with the *Sacrolumbalis*, from the back part of the Spine of the *Os Ilium*, the upper part of the *Sacrum*, and the Spines of the *Vertebræ* of the Loins; and in its aſcent is inſerted with it into the tranſverſe Proceſſes of the *Vertebræ* of the Loins, as before noted, *Chap.* XXI. After their Diviſion upon the laſt Rib, the inner Muſcle next the Spine takes the Name of *Longiſſimus Dorſi*, aſcending with a partly fleſhy, and partly tendinous outſide, and Fibres paſſing ſomewhat obliquely outward. Part of theſe tendinous Fibres ariſe diſtinct from the lower Spines of the *Vertebræ* of the *Thorax*, and the uppermoſt of the Loins; from which Tendons do likewiſe ariſe ſome fleſhy Fibres, which aſcending obliquely inwards, are afterwards inſerted into the fifth, ſixth, and

ſeventh

ſeventh Spine of the *Thorax*. This Part is by ſome improperly call'd *Semiſpinalis*. The other larger Part of this Muſcle, aſcending on the *Thorax*, divides it ſelf into many diſtinct Portions, not much unlike a Palm Branch, which are inſerted into the tranſverſe Proceſs of each *Vertebra* of the *Thorax*, into each Rib near its Tubercle, and into the three lower tranſverſe Proceſſes of the *Vertebræ* of the Neck;
Tab. XLV. *F.* whilſt a long fleſhy Production of it aſcends over the reſt of the tranſverſe Proceſſes
Tab. XXIII. 102. of the Neck, to its Inſertion into the *Os Occipitis*, behind the *Proceſſus Maſtoides*.

WHEN this and its Partner act in conjunction with the *Sacrolumbalis*, they are not only ſerviceable in keeping the Trunk of the Body erect and bending it backwards, but likewiſe in Progreſſion. For it may be obſerved, that when either Leg is moved forwards, theſe Muſcles on the ſame Side are in action; which to us ſeemeth to be advantagious for the more commodious Elevation of the Thigh, by rendring the *Os Ilium* and the *Vertebræ* of the Loins at that time ſtable; from which Bones the Benders of the Thigh take their Origine.

N. B. *To examine this Muſcle, it is beſt to uſe the Fingers, or the pointed Handle of a diſſecting Knife, to divide it from its Companion, the* Sacrolumbalis, *and diſcover its* Anſulæ, *as* Spigelius *calls thoſe Parts of it, which are inſerted into the tranſverſe Proceſſes of the* Vertebræ *of the Back and Loins.*

CIII.

Tab. XLIV. XLVI.

QUADRATUS LUMBORUM.

ARISES fleſhy from the poſteriour part of the Spine of the *Os Ilium*, whence it aſcends obliquely with various Orders of fleſhy Fibres, and is inſerted into all the tranſverſe Proceſſes of the *Vertebræ* of the Loins internally, under the *Pſoas* Muſcle, as likewiſe into the lower Edges of the two laſt Ribs. This, like the *Muſculus Rectus Abdominis*, either draws the *Vertebræ* of the Loins nearer the *Os Ilium* laterally, when we are ſtanding on both Legs, or elſe brings the *Os Ilium* nearer the ſaid *Vertebræ*, when we ſtand upon the oppoſite Leg only.

CIV.

Tab. XLV. XLVI.

SEMISPINATUS.

THIS might not improperly be call'd the *Tranſverſalis Dorſi*. It ariſeth fleſhy from all the tranſverſe Proceſſes of the *Vertebræ* of the *Thorax*, and marching obliquely upwards is inſerted into the ſuperiour Spines of the ſaid *Vertebræ*. This with the following Muſcle and *Tranſverſalis Colli* acting together on one ſide, move the whole Spine, or *Vertebræ* of the Neck, Back, and Loins, obliquely backwards, as when we endeavour to look behind us: If they all act together on both Sides, they aſſiſt in erecting the Trunk of the Body.

WE

CV.

SACER. *Ibid.*

THIS may be alſo called *Tranſverſalis Lumborum.* It lies under the tendinous part of the *Longiſſimus* above-mentioned, ariſing fleſhy from the *Os Sacrum,* and the tranſverſe Proceſſes of all the *Vertebræ* of the Loins, and is inſerted into their ſuperior Spines. We have ſometimes obſerved a *Spinalis Lumborum,* like the *Spinalis Colli* above deſcribed, which ariſing from the Superior Spines of the *Os Sacrum,* and marching with direct fleſhy Fibres, is ſo inſerted into the Spines of the upper *Vertebræ* of the Loins; the *Tranſverſalis Lumborum,* now deſcribed, lying under it.

CVI.

MUSCULUS COCCYGIS. *Tab.* IX. XLV.

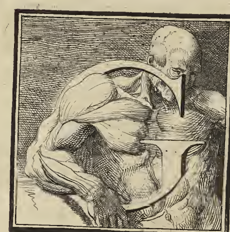
ARISES narrow, partly fleſhy and partly tendinous, from the acute Proceſs of the *Os Iſcium,* and dilating it ſelf into a broad thin Belly, is inſerted laterally along the whole *Os Coccygis.*

WE need not wonder at the many *Multiform* Muſcles inſervient to the Extention or Erection of the Head, Neck, Back and Loins, if we conſider how great a force is required to ſuſtain the Head and *Thorax,* on account of their projecting ſo much forwards from the *Vertebræ.* For if we take a view of the Skeleton, *Tab.* VI. we ſhould think the Body conſtantly liable to fall on its Face, were it not ſupported by theſe many ſtrong Muſcles. In which we have a plain demonſtration of the immenſe Wiſdom of the moſt wiſe Architect, in framing a Structure projecting from its *Fulcimen,* which for ſeveral Ends (too numerous to ſpecify here) is to be moved forwards, backwards, and ſideways, and could by no other means be ſupported ſo, as to render it upon occaſion flexible, but by Muſcles; they being capable of a much greater Contraction and Relaxation, than any other ſpringy Bodies, compoſed of Ligaments, &c.

THUS having breifly treated of all thoſe Muſcles, as yet known, that appear on the Trunk of the Body, we come next to thoſe belonging to the Limbs, and firſt to thoſe that move the Arm; two of which, namely, the Pectoralis *and* Latiſſimus, *we were obliged to diſſect before, to diſcover the ſubjacent Muſcles; but we ſhall now deſcribe them among the reſt, as the order of Diſſection requires. For the more convenient Adminiſtration of theſe Muſcles, we are wont to take off the whole Arm, together with the* Scapula *and* Clavicula, *by dividing the latter from the* Os Pectoris, *by which means the trouble in examining them is leſſen'd, thoſe moving the* Scapula *being cut from it.*

Chap. XXV.

Of the MUSCLES *of the* Arm, *or* Os Humeri.



GALEN*, *Jacobus Sylvius* †, and *Vesalius* ‡, describe seven Muscles belonging to each Arm, *viz. Pectoralis, Deltoides, Teres Major, Latissimus Dorsi, Supraspinatus, Infraspinatus*, and *Subscapularis*. *Arantius*, in his Anatomical Observations, counts another by ** *Rioland* called *Coracobrachieus*, to which †† *Julius Casserius Placentinus* adds the *Teres Minor*, by some reckoned as the eighth Muscle of this part, which is therefore called *Octavus Humeri Placentini*. Of these in their Order.

CVII.

Pectoralis.

Tab. 1. XLVII.

SO called from its Situation. This hath a broad, semicircular, fleshy Beginning, above, from near half the inferiour part of the *Clavicula*, below, from the *Os Pectoris*, and all the cartilaginous Endings of the six superiour Ribs; and from the Bony Part of the seventh it hath a distinct *Fasciculus* of fleshy Fibres, which

* *Cap.* 18. † *Isagog. Anatom.* ‡ *Lib.* 2. *Cap.* 24. ** *Lib.* 5. *Cap.* 24.
†† *Tab.* 17. *Lib.* 4. *Spigelii.*

sometimes

ſometimes we have ſeen confounded with the *Obliquus Deſcendens Abdominis.* From this large Origin it marcheth tranſverſly, and becoming narrower but thicker, leſſens it ſelf as it paſſeth over the upper part of the *Biceps Cubiti,* and is inſerted by a ſhort, but broad ſtrong Tendon, into the ſuperiour part of the *Os Humeri,* from immediately above the Termination of the following Muſcle, to the ſmooth Head of the Bone, where it joins with part of the *Ligamentum Latum* of the *Humerus,* which Ligament is connected with the *Ligamentum Faſciale* of the *Muſculus Infraſpinatus, Teres Minor,* and *Major.*

The Fibres of this Muſcle decuſſate each other, near their Implantation into the *Os Humeri;* thoſe of the ſuperiour part running downwards, and thoſe of the inferiour marching up, and interſecting the former in acute Angles.

WHEN this Muſcle acts, it moves the Arm obliquely upwards, directly forwards, or obliquely downwards; according to the various Direction of its *Series* of *Fibres.*

CVIII

DELTOIDES.

Tab. XLVII. XLIX.

SO called from its Figure, being like the *Greek* Δ. It hath a broad Origination, forwards from above one third of the inferiour and external part of the *Clavicula,* where it is entirely fleſhy; backwards it ſpringeth partly fleſhy, but chiefly tendinous, from the whole inferiour Margin of the *Spina Scapulæ.* In its deſcent from this Origine, it ſoon becomes thick and fleſhy, growing narrower, till it is inſerted by its partly fleſhy, and partly tendinous *Apex,* into the middle of the *Os Humeri.* This draws the Arm either directly upwards, or ſomewhat forwards, or backwards, according to the Direction of its differing *Series* of *Fibres.*

CIX.

SUPRASPINATUS.

Tab. VIII. XLI. XLVII.

SO called, becauſe it is placed above the Spine of the Shoulder-Blade. It ariſeth fleſhy from that part of the *Baſis Scapulæ,* that is above its Spine, as alſo from the ſaid Spine, and *Coſta Superior* of the *Scapula;* from whence paſſing between the *Proceſſus Coracoides,* and *Anchoriformis,* it grows leſs, and becoming tendinous, marches over the Articulation of the *Humerus,* joining its Tendons with the following, and is inſerted into the Head of the *Os Humeri.* The proper Uſe of this Muſcle is to lift the Arm upwards towards the *Occiput.*

CX.

Tab. XLI. XLVII.

Infraspinatus.

So called becauſe it lies below the Spine. This ariſes fleſhy from the inferiour part of the *Baſis Scapulæ*, as alſo from its Spine, its inferiour *Coſta* and *Dorſum*; from hence paſſing in a triangular Form according to the Figure of the Part, and leſſening itſelf as it marches over the juncture, it becomes tendinous, and is inſerted like the former into the Head of the *Os Humeri*. This moves the Arm directly backwards.

CXI.

Ibid.

Teres Minor.

So called from its Figure and Magnitude, to diſtinguiſh it from the following.

This Muſcle in ſome Bodies cannot be diſtinguiſhed from the former, but in others we have found it diſtinct enough.

It ariſes fleſhy from the lower part of the inferiour *Coſta* of the *Scapula*, and deſcends obliquely over the ſuperiour Head of the *Gemellus*, where becoming tendinous, it is inſerted into the Head of the *Os Humeri*.

When this acteth, the Arm is moved backwards.

CXII.

Tab. XLI. XLVIII. XLIX.

Teres Major.

This ariſes from the inferiour Angle of the *Scapula*, and becoming a round fleſhy Body, aſcends obliquely below the former, and paſſes under the ſuperiour Head of the *Gemellus*, where it becomes a ſhort, flat Tendon, inſerted below the Neck of the *Os Humeri*, cloſe to that of the following.

This draws the Arm backwards, and ſomewhat downwards.

CXIII.

Tab. VII. XLVIII.

Latissimus Dorsi, *ſive* Aniscalptor.

The firſt Appellation it receives from its large Dimenſions, the whole Back being cover'd with it and its Partner; the latter from the uſe, that is ſometimes made of it. Its thin, broad, tendinous Origination, is continued from the ſeven inferior Spines of the *Vertebræ* of the *Thorax*, all thoſe of the Loins, the upper ones of the *Os Sacrum*, and the back part of the Spine of the *Os Ilium*; it begins to grow fleſhy, as it paſſes over the *Longiſſimus Dorſi* and *Sacrolumbus*; and in its Progreſs over the curvated part of the Ribs it receives ſeveral *Faſciculi* of fleſhy Fibres ariſing from them in ſeveral Fiſſures of the *Obliquus Deſcendens*, which by

by their Conjunction compoſe a thick Body, ſtill leſſening it ſelf in its Dimenſions, as it marcheth towards the *Axilla*, and running over the inferiour Angle of the *Scapula*, from which ſometimes does ariſe a fleſhy part of it, which I have obſerved in thoſe Bodies in which the *Teres Minor* was abſent, being at laſt inſerted by a ſhort, but flat, ſtrong Tendon, into the *Os Humeri* near the former.

THE next Muſcle that preſents it ſelf, is the *Coracobrachialis*, by ſome called *Perforatus*, which is deſcribed by *Galen* and *Veſalius*, as part of the internal Head of the *Biceps Cubiti*.

CXIV.

CORACOBRACHIALIS.

Tab. XLVIII. XLIX.

SO called from its Origination and Inſertion. It ariſes partly fleſhy, and partly tendinous, from the Extremity of the *Proceſſus Coracoides Scapulæ*, and in its deſcent it becomes larger, ſtrictly adhering to the internal tendinous Beginning of the *Biceps*, and parts from it near its partly tendinous and partly fleſhy Inſertion at the middle of the internal part of the *Os Humeri*. Through this Muſcle paſſeth a large Nerve; wherefore by ſome it is called *Perforatus*.

WHEN it acts, the Arm is moved upwards, and turned ſomewhat obliquely outward.

CXV.

SUBSCAPULARIS.

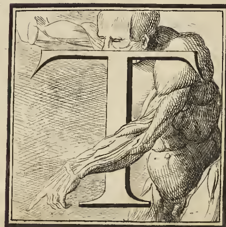
Ibid.

SO named from its Situation, by ſome called *Immerſus*. It is a large fleſhy Muſcle, filling the internal Concave part of the *Scapula*, ariſing fleſhy from its whole *Baſis* and *Superior* and *Inferior Coſta* internally; as it marches forward, it leſſens it ſelf according to the Dimenſions of the Bone, and paſſing over the Juncture, is inſerted in a ſemicircular Manner into the Neck of the *Os Humeri*.

THIS Muſcle draws the *Os Humeri* down cloſe to the Ribs. Its Tendon together with thoſe of the *Supraſpinatus*, *Infraſpinatus*, and *Teres Minor*, unite near their Inſertions, and join with the broad Ligament of the Articulation of the *Os Humeri* with the *Scapula*.

IN moving the Arm circularly, theſe laſt named Muſcles act ſucceſſively.

CHAP. XXVI.
Of the MUSCLES *of the* CUBIT.



THE lower part of the Arm from the Elbow to the Wrist is called the *Cubit*, which is bended and extended by five Muscles, namely, *Biceps*, *Brachiæus Internus*, *Gemellus*, *Brachiæus Externus*, and *Anconæus*.

CXVI.
BICEPS.

Tab. XLIX. L.

HATH two Heads or Beginnings; the first or outermost of which arises with a long round Tendon from the upper part of the Brink of the *Acetabulum Scapulæ*, and runs under the Ligament of the Articulation, in a *Sulcus* or Chanel on the Head of the Shoulder-Bone, wherein it is inclosed by a proper Ligament. In its Descent it begins to grow fleshy, as it marcheth under the Termination of the Pectoral Muscle, where dilating it self into a large fleshy Body, it joins with the internal Head or Beginning. This ariseth with a somewhat broad, flat, and long Tendon at the Extremity of the *Processus Caracoides Scapulæ*; in its descent it strictly adheres to the *Coracobrachialis*; on which account some Authors, not rightly describing that Muscle amongst those of the Arm, have mistaken it for a fleshy Beginning of this. But then parting from it, both these Heads compose a large fleshy Belly, which becoming tendinous near the *Cubit*, is commonly said to be inserted by a strong, round Tendon, into the Tubercle near the upper Head of the *Radius*. But we have observed this Tendon to be double, the External Part of which being thin, passeth obliquely over the *Musculus Pronator Radii Teres*, and Membrane-like expanding it self, joins with the *Membrana Communis Musculorum*, which embraceth all the external Muscles of the *Carpus* and Fingers.

WHEN this Muscle acts, the *Cubit* is bended.

THE double tendinous Termination of this Muscle, (tho' not taken notice of by any Author, that we know) is very evident, and was observ'd first by us some Years since, in dissecting these Muscles, in Company with our very good Friend, that most indefatigable and curious Botanist Mr. *Samuel Doody*. It appeareth immediately under the Skin and *Membrana Adiposa* of the *Cubit*.

THIS

THIS external Tendon, which we call *Faſcia Tendinoſa*, ſeems not to be deſigned only for the more advantagious elevation, or bending of the *Cubit*, which it more eaſily moves, by how much the more it recedes from the centre of its Motion or *Fulcimen* at the lower part of the Arm-Bone. For as it ſtrictly includes all the external Muſcles, whether belonging to the *Radius*, *Carpus*, or Fingers, it thereby corroborates them in performing thoſe ſtrenuous Actions they are neceſſarily employ'd in. This latter Uſe was firſt ſuggeſted to us, by obſerving thoſe artificial Bandages made of Leather, which ſome laborious Mechanicks make uſe of, adapting them to the belly'd part of the Muſcles of the *Cubit*; amongſt which Turners, and eſpecially thoſe that uſe the Raſp, in making the Frames for Cane-Chairs, (as they are commonly called) like a double Screw, are frequently obliged to this Artifice.

IN *Phlebotomy* the *Ductus* of theſe external tendinous Fibres ought to be reſpected, by directing the Launcet according to their Length, to avoid too great a diviſion of them, which is frequently the occaſion of thoſe ill Symptoms, that remain after that ſo commonly practiſed Operation by bold Blood-Letters.

AN extraordinary Caſe, relating to this Muſcle, has more than once happened in our Practice. Particularly a Woman, three days before ſhe conſulted us, had, (as ſhe ſuſpected) diſlocated her Shoulder-Bone, by wringing of Linen Clothes after waſhing, (which is commonly done to expreſs the Water) adding, that in ſtraining her Arm, in that Action, ſhe ſenſibly felt ſomething (as ſhe thought) ſlip out of its place on her Shoulder. After examining the Part, we were well ſatisfy'd that there was no Diſlocation: But obſerving a Depreſſure on the external part of the Deltoide Muſcle, and finding the two inferiour Tendons of this Bicipital Muſcle rigid, and the *Cubit* thereby denied its due Extenſion, we ſuſpected that the external tendinous Beginning, (before taken notice of) was ſlipt out of its Chanel on the Head of the *Os Humeri*; but finding the part at that time ſomewhat inflamed, we adviſed her to an emollient Application, and to give her Arm reſt till the next Day, at which time we found our Conjecture true; for by turning the whole Arm to and fro, the Tendon readily ſlipt into its place, ſhe recovering the Uſe of the Part immediately.

CXVII.

BRACHIÆUS INTERNUS.

Ibid.

THIS derives its Name from its Situation, lying partly under the former. It ariſeth fleſhy from the internal part of the *Os Humeri*, at the Inſertion of the *Deltoides* and *Coracobrachialis* Muſcles, and deſcending over the Juncture of the *Cubit* with the Arm-Bone, it's inſerted partly fleſhy and partly tendinous into the ſuperiour and fore part of the *Ulna*. This is alſo a Bender of the *Cubit*.

CXVIII.

Ibid.

Gemellus.

So called from its double Origine. It ariſeth firſt tendinous from the upper part of the inferiour *Coſtâ* of the *Scapula* internally, and as it paſſeth between the two round Muſcles it grows fleſhy, and in its Deſcent joineth with its other Beginning; which ariſeth broad and fleſhy from the upper and back part of the *Os Humeri*, under the Deltoid Muſcle; and being tendinous on the outſide and fleſhy within, is ſo inſerted into the ſuperiour and external part of the *Ulna*, called *Olecranum*, and *Ancon*, or the Elbow.

Its Uſe is to extend the *Cubit*. If we examine the two Beginnings of this Muſcle, we ſhall find them interwoven with various Orders of Fibres, whereby it is render'd capable of performing the Extenſion of the *Cubit* with a greater Strength, as appears in Tumblers when they are walking on their Hands, who by a ſudden Extenſion of their *Cubits* can return to their Feet.

CXIX.

Ibid.

Brachiæus Externus.

This ſeems to be the third Beginning of the former Muſcle. Its Origination is continued from above the middle of the inferiour and back part of the *Os Humeri* to its Cavity, which receives the *Olecranum* in the Extenſion of the *Cubit*, where, joining with the tendinous outſide of the former, it is inſerted with it, as aboveſaid.

CXX.

Ibid.

Anconæus.

So called by * *Riolan* from its Situation. It ariſeth fleſhy from the inferiour and back part of the *Os Humeri*, growing larger as it marcheth between the ſuperiour Ends of the *Ulna* and *Radius*, and is inſerted fleſhy into the lateral part of the former about two Inches below the *Olecranum*.

This is alſo an Extender of the *Cubit*.

The Muſcles of the Palm of the Hand offer themſelves next to be diſſected, before we can examine thoſe of the Carpus, Fingers, *and* Radius.

* *Lib.* 5. *Cap.* 24.

Chap.

CHAP. XXVII.

Of the MUSCLES *of the* PALM *of the* HAND.

ALL the Anatomists before *Falloppius* mention but one Muscle belonging to the Palm of the Hand, except *Valverda*, who, from the Observation of *Johannes Baptista Cannanus*, adds the *Palmaris Brevis*.

CXXI.

PALMARIS LONGUS.

Tab. XLIX. LI.

THIS has a narrow Beginning from the internal Extuberance of the *Os Humeri*, and soon becoming a fleshy Belly, contracts it self again to a long, flat, slender Tendon, marching obliquely with the Tendon of the *Flexor Carpi Superior*, and passing over the *Ligamentum Annulare*, where it expands it self, and cleaves firmly to the Skin of the Palm, and is afterwards inserted into the Roots of the Fingers laterally; it being there divided to transmit the Tendons that bend them.

COLUMBUS * observes the long beginning of this Muscle from the Extuberance of the *Os Humeri* is sometimes wanting, which Observation is also confirmed by our own Experience. It assists in grasping, and defends the subjacent Tendons from external Injuries.

CXXII.

PALMARIS BREVIS.

Ibid.

BY *Spigelius* † called *Caro Musculosa Quadrata*. Anatomists have been extremely deceived in their Ideas of this Muscle; it not arising from the *Membrana Carnosa*, as *Columbus* pretends, or from the eighth Bone of the *Carpus*, as *Falloppius* ‡ writes; but it springs with a broad Membrane-like Tendon from the exter-

* *Lib.* 5. *Cap.* 33. † *Lib.* 5. *Cap.* 35. ‡ *Observat. Anatom.*

nal Part of the *Os Metacarpi Minimi Digiti*, and one of the Bones of the *Carpus*; whence aſcending over the *Abductor Minimi Digiti*, it becomes a thin diſgregated fleſhy Muſcle, marching under the tendinous Expanſion of the former in the Palm, and is inſerted by a ſhort, ſtrong Tendon, into the eighth Bone of the *Carpus*.

This draws the *Mons Lunæ* towards the *Os Metacarpi Minimi Digiti*, whereby the Palm becomes hollow; contrary to the Opinion of *Spigelius*, who thinks it extends the Hand, when we open it; which is not done by any proper Muſcle, but by the common Extenders of the Fingers.

Chap. XXVIII.

Of the MUSCLES *of the* Four Fingers.

THESE we ſhall divide into *Common* and *Proper*. The *Common* Muſcles of the Fingers are ſuch, as ariſe from the external or internal Protuberances of the *Os Humeri*, and ſubdividing themſelves, are inſerted into moſt, if not all the Fingers; namely the *Perforatus*, *Perforans*, *Lumbricales*, and *Extenſor Communis Digitorum*. The *Proper* Muſcles of the Fingers are ſuch as have their Beginnings diſtinct, and are inſerted without any Subdiviſion into each reſpective Finger; as the *Interoſſei*, the *Extenſor* and *Abductor Indicis*, the *Extenſor* and *Abductor Minimi Digiti*. Firſt of the *Common* Muſcles of the Fingers.

CXXIII.

Perforatus. *Tab.* II. XLIX. LI.

SO called, becauſe its Tendons are perforated, to admit thoſe of the following Muſcles to paſs through them to their Inſertions: It is alſo call'd *Sublimis* from its Situation, being above the following; and *Flexor ſecundi Internodii Digitorum* from its Uſe. It ariſeth tendinous from the internal Extuberance of the *Os Humeri* between the *Flexores Carpi*; it alſo has a diſgregated fleſhy Origination from the fore

fore part of the *Radius*, between the *Pronator Radii Teres* and *Flexor Pollicis Longus*; afterwards compoſing a fleſhy Belly, it leſſens it ſelf in leſs than half its Progreſs, where it's divided into four fleſhy Portions, each of which ſoon becomes a roundiſh Tendon, included in its proper mucilaginous Membrane, as it paſſes under the *Ligamentum Tranſverſale Carpi* through the Palm. Near the firſt Internode of the Fingers each Tendon is divided, to admit thoſe of the following Muſcle to paſs through them, then joining, and ſubdividing again, immediately before they are inſerted into the ſuperiour part of the ſecond Bone of each Finger.

CXXIV.

Tab. II. LI.

PERFORANS.

SO named, becauſe its Tendons run through thoſe of the former; it's alſo called *Profundus* from its Situation, and *Tertii Internodii Digitorum Flexor* from its Uſe. It ariſeth fleſhy from near two Thirds of the ſuperiour and fore part of the *Ulna*, as alſo from the Ligament between the laſt named Bone and the *Radius*, and becoming a large thick belly'd Muſcle, grows outwardly tendinous, before it paſſes over the *Pronator Radii Quadratus*, and is divided into four round Tendons, which march under thoſe of the former Muſcle, beneath the *Ligamentum Tranſverſale* above-mentioned, (from each of which Tendons the *Muſculi Lumbricales* are ſaid to ariſe) after which they paſs through the *Fiſſures* of thoſe of the former Muſcle, and proceeding over their Extremities, terminate in the ſuperiour and fore part of the third Bone of each Finger.

THE running of the Tendons of the laſt deſcribed Muſcle through thoſe of the precedent, is a no leſs uſeful than ſtupendous Artifice in Nature.

THE better to accommodate the Fingers to their various Employments, and to enable them to act with greater Strength, it was neceſſary, that a particular Muſcle ſhould be appointed for every Internode, and that the ſtrongeſt Muſcle ſhould be inſerted neareſt to their Extremities. Now as the *Perforatus* takes its Origine from the internal Extuberance of the *Os Humeri*, and the upper part of the *Radius*, it is plain, that this cannot be an Inſtrument of ſufficient Strength for moving the third Internode of the Fingers, not only in regard to its Magnitude, but on the account of the approach of its two Extremes, when the Cubit is bended, which muſt needs be of no ſmall Impediment to it in divers Actions. This therefore is with great Wiſdom ſet aſide for the Motion of the ſecond Internode; and the *Perforans*, which is not only the larger Muſcle, but likewiſe takes its Origination below the *Os Humeri*, whereby it is freed from the above-mention'd Inconvenience in the bending of the Cubit, is allotted for the Motion of the third Internode, which, as we ſaid before, ought to be attended with the Muſcle of the greateſt Strength. Beſides that by this Diſpoſition a Proviſion is made for bending the Fingers, even when the outermoſt Muſcle happens by any accident to be totally divided.

CXXV.

LUMBRICALES.

Tab. LI. LII.

SO called from their Figure, being not much unlike the common Earth-worms; they are alſo called *Flexores Primi Internodii Digitorum*, from their Uſe. Anatomiſts generally derive the Originations of theſe Muſcles from the Tendons of the laſt treated of; but in a Subject lately diſſected, I obſerved part of the Lumbrical Muſcle belonging to the fore Finger had a diſtinct fleſhy Original, and a long ſlender Tendon lying between the two preceding; which ſuggeſted to me, that the other three, and thoſe of other Subjects, have their Beginnings in common with the *Perforans*, and uniting with its Tendons, are afterwards diſunited again, and growing fleſhy, paſs to their tendinous Implantations with the *Interoſſei*, at the firſt Internode of each Finger externally and laterally, next the Thumb.

THESE, we ſuppoſe, perform thoſe minute Motions of the Fingers, when the ſecond and third Internodes are curvated by the two laſt treated of Muſcles; and are therefore uſed in playing on Muſical Inſtruments, whence they may be named *Muſculi Fidicinales*.

CXXVI.

EXTENSOR DIGITORUM COMMUNIS, *ſeu* DIGITORUM TENSOR.

Tab. V. VII. XLIX. LII.

THIS has an acute tendinous Origination from the outward Extuberance of the *Os Humeri*, between the *Extenſores Carpi*; and becoming fleſhy, in leſs than half its Progreſs is divided into three Portions, which become ſo many Tendons, (of which the middlemoſt is the longeſt) paſſing under their annular Ligaments between the lower Parts of the *Ulna* and *Radius*; then marching ſeparately over the *Dorſum Manus*, and remitting tendinous Filaments to each other, before they paſs the firſt Internodes of each Finger, they are afterwards inſerted into the ſuperiour Parts of the firſt, ſecond, and third Bones of the fore, middle, and third Fingers.

THERE being little Force required in the Extenſion of the Fingers, we need not wonder that the Muſcles, employed in that Office, are no larger in proportion to their Antagoniſts.

THE *Proper* Muſcles of the Fingers now offer themſelves to the Knife, which we ſhall treat of in the Order they are above named in.

CXXVII.

Tab. LI. LII.

INTEROSSEI MANUS.

THESE are diſtinguiſh'd into external and internal, and are aptly named from their Situation. Authors diſagree in their Number, ſome reckoning ſix, others eight, amongſt which they eſteem the *Abductor Minimi Digiti* and *Indicis*; but we rather incline to the firſt Opinion, ſince the two laſt named Muſcles are not placed between the Bones of the *Metacarpus*. They ariſe fleſhy, internally, in the Palm from the ſuperiour Parts of the Metacarpal Bones next the *Carpus*; whence deſcending between the laſt named Bones, they become tendinous at the firſt Internode of each Finger laterally, and paſs to their Inſertions with the laſt treated of Muſcle, ſending off in their way a ſmall Slip to the beginning of the firſt Internode. Each Interſtice of the Metacarpal Bones entertains two of theſe Muſcles.

WHEN all the *Interoſſei* act together, they draw the Fingers nearer each other, and aſſiſt in their Extenſion, as *Galen* * takes notice; at which time likewiſe part of theſe Muſcles, together with the *Abductor Indicis* and *Minimi Digiti*, are capable of divaricating the Fingers; which Action cannot without ſome difficulty be performed by them, when the Fingers are bended; which Contrivance of the moſt wiſe Architect is alſo obſerv'd by *Galen* †.

CXXVIII.

Tab. V. VI. VIII. LII.

EXTENSOR INDICIS, *ſeu* INDICATOR.

ARISES fleſhy from the middle of the external part of the *Ulna* next the *Radius*, immediately below the *Extenſores Pollicis*, and deſcending obliquely, becomes tendinous, as it paſſes under its annular Ligament at the lower part of the *Radius* and *Carpus*; then paſſing over the *Os Metacarpi Indicis*, and joining with the Tendon of the *Extenſor Communis*, it is inſerted with it into the ſuperiour Part of the third Bone of the fore Finger. The Tendon of it is ſometimes divided. Its Name declares its Uſe.

CXXIX.

Tab. LI. P. *Tab.* LII.

ABDUCTOR INDICIS.

THIS is not to be diſſected, till the *Abductor Pollicis* is raiſed; by ſome it is reckoned among the *Interoſſei*, as above noted. It ariſes fleſhy from the *Os Metacarpi*, that ſuſtains the fore Finger; and deſcending over the firſt Internode of the ſaid Finger, becomes tendinous, joining with the Tendon of one of the Lumbrical Muſcles, and is inſerted with it, together with the Tendon of the former Muſcle. Its Name intimates its Uſe, in drawing the fore Finger from the reſt.

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* *Lib.* I. *de Uſu Part.* † *Loco ſuprà citato.*

CXXX.

CXXX.

EXTENSOR MINIMI DIGITI.

Tab. V. VII. VIII. LII.

THIS ariſes partly tendinous at the Extremity of the external *Apophyſis* of the *Os Humeri*, and partly fleſhy from the ſuperiour part of the *Ulna*, between the *Extenſor Communis Digitorum* and *Muſculus Ulnaris Extenſor*, and becoming tendinous, as it paſſes under the *Ligamentum Annulare* at the *Carpus*, it is there divided into two, ſometimes three Tendons, which are united into one at its Inſertion into the ſuperiour Part of the third Bone of the Little Finger. Its Name declares its Action.

CXXXI.

ABDUCTOR MINIMI DIGITI.

Tab. LI. LII.

THIS appears in ſome Bodies divided into two or three Muſcles, having each a differing Series of Fibres; the firſt of which ſeems to be a *Flexor primi Internodii Minimi Digiti*; the ſecond an *Abductor* of the ſame; the third *Abductor Secundi & Tertii Internodii*. But this Diviſion not being conſtant, we ſhall deſcribe it as one Muſcle, to avoid a needleſs multiplying the Number of the Muſcles. It ariſes fleſhy, firſt from the *Ligamentum Tranſverſale*, and fourth Bone of the *Carpus*; ſecondly from the third Bone of the *Carpus*; thirdly and laſtly from the ſuperiour Part of the ſubjacent *Os Metacarpi*. The two firſt continue fleſhy to their Inſertions; the former terminating at the ſuperiour part of the firſt Bone of the little Finger Forwards, the latter ending at the ſame part of the ſaid Bone laterally; the third and laſt becoming tendinous like the *Interoſſei*, is inſerted like them, with the Tendon of the *Extenſor Minimi Digiti*, at the ſuperiour part of the third Bone of the little Finger.

CHAP.

CHAP. XXIX.
Of the MUSCLES *of the* THUMB.

AUTHORS diſagree concerning the Number, Riſe and Inſertions of theſe Muſcles; which may partly proceed from that great Variety to be obſerv'd in divers Subjects. As they have moſt commonly appeared to me, I ſhall endeavour to repreſent them; and firſt the Benders of the Thumb.

CXXXII.

Tab. II. III. VI. LIII.

FLEXOR TERTII INTERNODII, *ſeu* LONGISSIMUS POLLICIS.

THIS we have frequently obſerv'd to have a twofold Beginning; the firſt and ſuperiour of which ariſes tendinous from the internal Extuberance of the *Os Humeri*, between the *Perforatus* and *Perforans*, becoming a fleſhy Belly, and then tendinous again, before it joins with the middle Tendon of its other larger Head. This firſt Head is ſometimes wanting, and ſometimes it is found ſpringing from the ſuperiour and fore part of the *Ulna*. The ſecond or inferiour Origine of this Muſcle is that part of it, which is commonly deſcribed, ariſing with a double Order of fleſhy Fibres for ſome ſpace on the *Radius*, from immediately below its ſuperiour Part, which unite in a middle Line or Tendon, (not unlike the *Fibrillæ* of a Feather joining to their *Stamina)* and paſſing over the Articulation of the *Carpus*, it becomes entirely tendinous, as it runs over the *Flexor primi & ſecundi Internodii* to its Implantation at the ſuperiour Part of the third Bone of the Thumb. For the better Diſſection of the reſt of the Muſcles of this Part, raiſe firſt the following Muſcle.

CXXXIII.

Tab. XLIX. LIII.

ABDUCTOR POLLICIS.

THIS ariſes broad and fleſhy from the *Os Carpi*, to which the Thumb is articulated, and the internal Part of the *Ligamentum Tranſverſale Carpi*, whence deſcending, it leſſens it ſelf, and becomes tendinous at its Implantation into the ſuperiour and external Part of the ſecond Bone of the Thumb laterally.

THIS

THIS draws the Thumb from the Fingers, from whence it derives its Name.

CXXXIV.

FLEXOR PRIMI & SECUNDI OSSIS POLLICIS.

Tab. III. XLIX. LIII.

THIS is a large, disſgregated, fleſhy Muſcle, ariſing from the *Ligamentum Tranſverſale Carpi*, the Bones of the *Carpus* at the *Baſis* of the *Mons Lunæ*, and the *Os Metacarpi* of the middle Finger, whence it paſſes to its Inſertion into the firſt and ſecond Bones of the Thumb. That part of this Muſcle, that ariſes from the *Os Metacarpi* of the middle Finger, is divided from its other part by the Tendon of the *Flexor Pollicis Longus* paſſing between them. Beſides which, there is a ſecond Diviſion of this Muſcle in that Part, which ariſes from the *Os Metacarpi*, inſomuch that it has the appearance of three diſtinct Muſcles, as *Veſalius* obſerves. In its Tendon, near the Inſertion into the firſt Bone of the Thumb, are placed two *Oſſa Seſamoidea*.

ITS Actions are various, according to the diverſity of its *Series* of Fibres, bending the Thumb either directly, or obliquely, whether towards the *Carpus*, or the Palm of the Hand, which Motions are frequently made uſe of by Jugglers.

CXXXV.

ADDUCTOR POLLICIS.

Tab. LI. O. *Tab.* LIII.

THIS ariſes tendinous in common with the *Abductor Indicis* from the *Os Metacarpi* of the fore Finger, and becoming fleſhy, aſcends obliquely to its tendinous Termination at the ſuperiour part of the firſt Bone of the Thumb. This brings the Thumb nearer the fore Finger.

THE reſt of the Muſcles employed in the Motion of the Thumb are Extenders. Though Anatomiſts generally reckon but two of them, yet it does not occur to our Memory, that we ever found leſs than three diſtinct fleſhy Muſcles; neither do the Figures, that ſeem to be done after the Life, in *Veſalius* and *Bidloo*, exhibit them otherwiſe.

CXXXVI.

EXTENSOR PRIMI INTERNODII POLLICIS.

Tab. XLIX. LIII.

THIS ariſes partly tendinous, but chiefly fleſhy, from the upper Part of the *Ulna*, immediately below the *Supinator Radii Brevis*, ſoon growing fleſhy, and becoming tendinous again, as it deſcends obliquely over the Tendons of the *Radialis Extenſor*, and is inſerted into the lower part of the firſt Bone of the Thumb. This we have ſometimes found divided into two, and ſometimes three, diſtinct Muſcles.

CXXXVII.

Ibid.

EXTENSOR SECUNDI INTERNODII POLLICIS.

THIS ariſes broad and fleſhy from part of the *Radius* next the *Ulna*, and becoming tendinous, paſſes under the ſame *Involucrum* with the Tendons of the former, to its Implantation at the lower part of the ſecond Bone of the Thumb.

CXXXVIII.

Ibid.

EXTENSOR TERTII INTERNODII POLLICIS.

THIS has a broad, partly tendinous, but chiefly fleſhy Origination from the *Ulna*, immediately below the beginning of the *Extenſor Primi Internodii*, or between it and the *Indicator*, as alſo from the Ligament between the laſt named Bone and the *Radius*; whence deſcending obliquely, it becomes tendinous, as it marches in a proper *Sinus* on the inferiour Appendix of the *Radius*, wherein it is incloſed by its annular Ligament, and paſſes over the two Tendons of the *Radialis Extenſor*, to its Inſertion at the lower part of the third Bone of the Thumb.

WHEN this acts, it does not only extend the Thumb, but brings it ſomewhat backwards, in ſo much that ſome Perſons can bring it over the ſuperiour and back part of the *Oſſa Metacarpi*

CHAP. XXX.
Of the MUSCLES *of the* WRIST, *or* CARPUS.

THESE are well deſcribed by moſt Authors, and receive their Names from their Situation and Uſe.

CXXXIX.
FLEXOR CARPI RADIALIS. *Tab.* XLIX. LIII.

THIS ariſeth tendinous from the internal Extuberance of the *Os Humeri*, and becoming fleſhy, adheres ſtrictly to the *Pronator Radii Teres*; and in half its oblique Progreſs to the *Carpus*, it becomes a flat Tendon, which paſſeth under the annular Ligament, and is inſerted into the upper part of the *Os Metacarpi*, which ſuſtains the fore Finger.

CXL.
FLEXOR CARPI ULNARIS. *Ibid.*

THIS ariſeth partly fleſhy, but chiefly tendinous, from the ſame Tubercle of the Shoulder-Bone with the former, as alſo from the ſuperiour and external Part of the *Ulna*, where the *Muſculus Perforans* ariſes; and continuing fleſhy according to the length of the *Ulna*, is partly inſerted by a ſhort, ſtrong Tendon, into the fourth Bone of the *Carpus*, and partly into the *Os Metacarpi*, which ſuſtains the little Finger.

CXLI.
EXTENSOR CARPI RADIALIS. *Ibid.*

BY ſome called *Bicornis* and *Radiæus Externus*. It hath two Beginnings, and indeed ſeems to be two diſtinct Muſcles, the outermoſt ariſing fleſhy above the external Protuberance of the *Os Humeri*, immediately below the *Supinator Radii Longus*, in its deſcent becoming a fleſhy Belly, and growing tendinous above the

the middle of the *Radius*. The other Beginning of this Muſcle is partly fleſhy and partly tendinous below the former, either from the *Apex* of the outward Extuberance of the *Os Humeri*, or the ſuperiour Part of the *Radius*, and continues fleſhy ſomewhat lower than the other; both Tendons marching under the *Extenſores Pollicis*, run under the *Ligamentum Annulare*, and are inſerted into the ſuperiour Parts of the *Oſſa Metacarpi* of the fore, and middle Fingers.

CXLII.

Ibid.

EXTENSOR CARPI ULNARIS.

THIS hath an acute tendinous Beginning from the outward Extuberance of the *Os Humeri*, and becomes fleſhy, as it deſcends according to the length of the *Cubit*, growing tendinous again as it marches over the inferiour part of the *Ulna*; and paſſing under the annular Ligament, it is inſerted into the ſuperiour Part of the Metacarpal-Bone of the little Finger.

IF this Muſcle and the *Ulnaris Flexor* act, they move the Hand ſideways towards the *Ulna*; and in like manner, if the *Radialis Flexor* and *Extenſor* act, they move it towards the *Radius*. It is well obſerved by moſt Authors, that the Extenders, whether belonging to the Fingers or *Carpus*, ariſe from the outward Extuberance of the *Os Humeri*, and their Antagoniſts the Flexors, from the internal Protuberance of the ſame Bone, as alſo from the ſuperiour and external Part of the *Ulna*, next the *Anconæus* (above treated of.)

CHAP.

CHAP. XXXI.
Of the MUSCLES *of the* RADIUS.

THE *Radius* is bent and extended in common with the *Ulna*, or *Cubitus*; but beſides that, it hath alſo a proper Motion, in which the *Carpus* together with the Hand is chiefly moved, or turned, either upwards or downwards. To this end there are two ſorts of Muſcles; of which ſome are called *Pronatores*, or thoſe that turn the *Radius* inwards, and the Palm of the Hand downwards; and others *Supinatores*, which turn it outwards, and the Palm of the Hand upwards. Theſe have their Names from their Figure and Uſe.

CXLIII. *Tab.* XLIX. LIV.
PRONATOR RADII TERES.

HAS two Beginnings; the one from the internal Extuberance of the *Os Humeri*, where the Muſcles bending the *Carpus* and Fingers ariſe; the other from the upper Part of the *Ulna*. From theſe two Heads its fleſhy Body marches obliquely, adhering ſtrictly to the *Flexor Carpi Radialis*, ſo as not to be fairly ſeparable from it, in its Paſſage to its tendinous Inſertion a little above the middle of the *Radius* externally.

CXLIV.
PRONATOR RADII QUADRATUS, *or* INFERIOR QUADRATUS. *Tab.* III. LIV.

IT ariſeth with a broad Tendon, from the lower and inner Part of the *Ulna*, and paſſing tranſverſly over the Ligament, that joins the *Radius* to the *Ulna*, is ſo inſerted into the ſuperiour and external Part of the *Radius*.

CXLV.

Tab. XLIX. LIV.

SUPINATOR RADII LONGUS.

THIS ariſeth broad and fleſhy from the external Part of the *Os Humeri*, three Fingers breadth below the Termination of the *Deltoides*; and deſcending obliquely inwards, it gradually leſſens it ſelf, and becomes a flat, broad Tendon, which likewiſe grows narrower till it is inſerted into the internal and inferiour Part of the *Radius*, near the *Carpus*.

CXLVI.

Tab. V. VI. IX. LIV.

SUPINATOR RADII BREVIS.

THIS ariſeth partly tendinous, and partly fleſhy, from the ſuperiour and external Part of the *Ulna* next the *Radius*; and paſſing obliquely over that Bone, is ſo inſerted into its ſuperiour Part below the Prominence of the *Radius*, where the round Tendon of the *Biceps* endeth.

WE come next to the Muſcles of the Thigh, Leg, and Foot. Though Riolan *ſharply reprehends* Caſpar Bauhin, *in his Animadverſions on his* Theatrum Anatomicum, *for Male-adminiſtration of the Muſcles of the Leg, before* thoſe *of the Thigh, alledging that thoſe of the Thigh may be all demonſtrated, while the Muſcles of the Leg remain untouched; yet we cannot agree with him in that particular, knowing it to be abſolutely neceſſary to ſeparate divers Muſcles of the* Tibia, *as well as to cut off ſome of thoſe moving the* Os Femoris *it ſelf, before we can have a tolerable Proſpect of others; eſpecially the* Rotator Femoris Extrorſum. *However ſince ſome Muſcles, which belong to the Thigh, ariſe from the* Vertebræ *of the Back, Loins, and* Os Sacrum, *we ſhall begin with them, and then divide the* Os Ilium *from the* Sacrum, *and remove the Trunk of the Body; which Practice is not only convenient for Diſſection, in reſpect that the Limb is more eaſily turned to and fro upon the Table; but in publick Demonſtrations is done to avoid an offenſive Scent apt to ariſe from the Trunk. This done, proceed to diveſt the reſt of the Muſcles of the Skin, Fat, and Membranes; taking care that the* Faſcia Membranoſa *of the Thigh and Leg be not wounded, and that you likewiſe take off all the Fat in the* Planta Pedis, *and avoid cutting the long Tendon of the* Muſculus Plantaris, *as it deſcends by the inſide of the great Tendon of the* Gaſterocnemii, *near the* Os Calcis.

Chap. XXXII.

Of the MUSCLES *of the* Thigh.

THE Enumeration, Deſcription and Office of the Muſcles belonging to this Part, is variouſly ſet down by different Authors. * *Galen*, † *Veſalius*, and ‡ *Columbus* mention ten, *viz. Pſoas, Iliacus Internus, Pectineus, Glutæus Major, Glutæus Medius, Glutæus Minor, Pyriformis, Marſupialis, Triceps*, and *Obturator Externus*. To theſe ** *Falloppius* adds another called *Quadratus Femoris*, whoſe Invention †† *Riolan* pretends is due to *Sylvius*, and deſcribes another, which he calls *Pſoas Parvus*, lying on the great *Pſoas*. To theſe ‡‡ *Tho. Bartholin* adds yet another diſtinct from that mentioned by *Riolan*, lying beneath it, having the ſame fleſhy Beginning about three Fingers in breadth, and being ſo inſerted into the upper Edge of the *Os Ilium* backwards, where the *Iliacus Internus* ariſes: This he tells us he found in a ſtrong Muſcular Body in the Year 1651; and the following Year he ſays he ſaw it with *Michael Lyſerus*, who had obſerved it in a Monkey to equal the great *Pſoas*. That mentioned by *Riolan* we have frequently obſerv'd, which notwithſtanding is abſent in ſome Bodies, as he has well remark'd. But the latter of *Bartholin* I could never yet diſcover. If any ſuch be

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* *De Muſc. Cap.* 31. † *Lib.* 2. *Cap.* 56. ‡ *Lib.* 5. *Cap.* 28. ** *Obſervat. Anatom.*
†† *Animad. in Theat. Anatom. Bauhini & Anthropog. Lib.* 5. *Cap.* 41. ‡‡ *Lib.* 4. *Cap.* 11.

found,

found, I conjecture it ſhould rather be referred to the Loins, together with the *Quadratus Lumborum*, of which I ſuſpect it is a Part, that may ſometimes be diſtinct. The like *Luſus Naturæ* we frequently find in other Caſes, of which the *Rhomboides Scapulæ* and *Triceps Femoris* afford us Examples.

CXLVII.

Tab. LIV.

PSOAS PARVUS.

THOUGH this ought to be counted among thoſe belonging to the Loins, yet for its ſubſerviency to the great *Pſoas*, and our better convenience in Diſſection, we chooſe rather to reſerve it for this Place. It ariſes fleſhy from the ſuperiour part of the firſt *Vertebra* of the Loins internally and laterally, within the Cavity of the *Abdomen*, immediately below the *Diaphragm*, whence it deſcends obliquely inwards, towards the *Pelvis Abdominis*, where it ceaſes to be fleſhy, in a manner embracing the great *Pſoas*, and is inſerted with a thin, broad, ſtrong Tendon, into that part of the *Os Pubis* that is joined to the *Os Ilium*. This Muſcle with its Partner may aſſiſt the *Recti Abdominis*, in drawing the *Oſſa Pubis* upwards, as in raiſing our ſelves from a decumbent Poſture. Thus Rope-dancers hang by their Hands, and raiſe the inferiour parts of their Bodies, to take hold of the Rope with their Feet, though their proper Action ſeems to be to bend the Loins. The Tendons of theſe Muſcles, embracing the two following, which we have frequently obſerved to extend over their inferiour Parts, not unlike the *Faſcia Tendinoſa Cubiti*, and *Lata* of the Thigh, do alſo corroborate them in their Action.

CXLVIII.

Tab. III. VI. LIV. LV.

PSOAS MAGNUS, *ſeu* LUMBALIS.

SO called from its Situation. It's a round, ſomewhat large and fleſhy Muſcle, ariſing from all the *Vertebræ* of the Loins, and their tranſverſe Proceſſes, internally and laterally, within the Cavity of the *Abdomen*; from thence deſcending over the ſuperiour part of the *Os Sacrum*, and Spine of the *Ilium*, where it is joined with the fleſhy Fibres of the following Muſcle, with which its inſeparably united, at their partly fleſhy, and partly tendinous Inſertion into the inferiour part of the leſſer *Trochanter* of the Thigh-Bone.

THIS aſſiſts the following in its Action.

CXLIX.

Tab. III. VI. LIV.

ILIACUS INTERNUS.

THIS ariſes fleſhy from above half the ſuperiour, internal, concave part of the *Os Ilium*, and in its deſcent over the inferiour part of the ſame Bone, joins with the former, and is inſerted with it as above-ſaid, partly under the Termination

tion of the following Muſcle. This together with the former move the Thigh forwards in Progreſſion.

CL.

PECTINEUS.

Tab. VI. LIV.

SO called from its beginning at the *Os Pubis* or *Pectinis*. It has a thick, broad, and fleſhy Origination from the external part of the ſaid Bone, between the two laſt deſcribed Muſcles and ſecond Head of the *Triceps*, and deſcending obliquely backwards, it becomes a flat ſtrong Tendon near its Implantation into the Aſperity on the poſteriour part of the *Os Femoris*, immediately below the leſſer *Trochanter*, at the Inſertion of the two former Muſcles.

THIS acting together with the two preceding, does not only aſſiſt in drawing the *Os Femoris* upwards, but likewiſe directs it outwards, by its Curve deſcent from its Origination to its Inſertion at the poſteriour part of the *Os Femoris*; which is a provident Contrivance of Nature in our walking, ſince the Thigh-bones, by their oblique Poſition, render the Toes liable to turn inwards. Theſe three laſt treated of Muſcles, beſides the *Recti Abdominis*, and *Pſoas Parvus* on each ſide, ſeem to ſerve for the Inflexion of the Body, and to direct the whole Limb, to wit, the Thigh, Leg, and Foot outward, in a more graceful Step.

THE Muſculus Membranoſus *preſents it ſelf next to the Knife; therefore muſt be raiſed, before we can gain a View of the reſt of the Muſcles, which move the Thigh-bone. This may be done, either by cutting it from its fleſhy Origination at the point of the Spine of the* Os Ilium, *and turning it downwards; or after its well cleared of the Skin, Fat, and Membranes, it may be raiſed contrariwiſe, by cutting off its tendinous Inſertion at the ſuperiour* Appendix *of the* Fibula, *freeing it from all the Muſcles of the* Tibia, *and leaving it at its Origination. Either of theſe being done, proceed to raiſe the* Pyriformis *from its Origine within the* Pelvis *of the* Abdomen, *and part of the fleſhy Beginning of the* Glutæus Major, *from the external part of the* Os Sacrum *and* Coccygis. *The Body then being laid in a Supine Poſture, and the Legs divaricated, with a thin Knife firſt divide the* Oſſa Pubis *from each other, and then the* Os Ilium *from the* Sacrum.

CLI.

GLUTÆUS MAJOR.

Tab. V. VII. LV. LVII.

SO called from its being the largeſt Muſcle of thoſe, which compoſe the Buttocks. It has a large ſemicircular Beginning; forwards merely tendinous, from near two thirds of the external part of the Spine of the *Os Ilium*; backwards its Origination is thick and fleſhy from the poſteriour part of its Spine, the hindmoſt part of the *Sacrum* laterally, and the whole *Os Coccygis*, as alſo from a broad Ligament, that's extended between the two laſt named Bones and the Tubercle of the *Os Iſchium*; its fleſhy Fibres, deſcending diſgregately, in an almoſt ſemicircular

 manner,

manner, become tendinous, as they approach the great *Trochanter*, where it is united with its firſt deſcribed tendinous Beginning, deſcending over the external part of the great *Trochanter*; then after being joined with the Tendon of the *Membranoſus*, it proceeds to cover and ſtrictly embrace all the external Muſcles of the *Tibia*, as the external Tendon of the *Biceps* does thoſe of the *Cubit:* But the other part of it proceeding from the fleſhy Body of this Muſcle, is largely inſerted into the *Linea Aſpera* on the back Part of the *Os Femoris*, near four Fingers breadth below the Great *Trochanter*.

THE firſt deſcribed tendinous Beginning of this Muſcle doth not only ſerve to ſupport its fleſhy Body; but its Fibres interſecting thoſe of the *Membranoſus*, as they cover all the Muſcles of the *Tibia*, do more adequately include them, whereby they are corroborated in their Action. When this Muſcle acts, it pulls the Thigh directly backwards.

CLII.

Tab. VII. VIII. LV. LVIII.

GLUTÆUS MEDIUS.

THIS lies chiefly under the tendinous beginning of the former Muſcle, and ariſing fleſhy from almoſt the whole external part of the Spine of the *Os Ilium*, in its Deſcent becomes thicker and fleſhy, and is inſerted by a ſhort ſtrong Tendon into the ſuperiour and external part of the great *Trochanter* in a ſemicircular manner.

IF the differing *Series* of Fibres in this Muſcle are rightly conſider'd, their Poſition will manifeſt, that they are not ſo uſeful in extending the Thigh, as Authors would perſuade us, but rather employed in turning it inwards. This will plainly appear, if in the time of Diſſection you give the Thigh that Motion, for you then may obſerve the fore part of this Muſcle notably relax'd. And in living Perſons, when the Thigh is turned inwards, you may ſee it tumified; or if, in performing that Action with your own Thigh, you lay your Thumb on this Muſcle, you may feel it contract or move under the Skin. Beſides its being partly uſeful in extending the Thigh with the former Muſcle, it is alſo employ'd in divaricating the Legs, it co-operating with the *Muſculus Membranoſus* in that Action.

N. B. *IN raiſing this Muſcle, begin towards the back Part of the* Os Ilium, *and thruſt in your Finger between it and the* Glutæus Minor *lying under it, by which means they will eaſily be ſeparated.*

CLIII.

Tab. VI. VIII. LVI. LVIII.

GLUTÆUS MINOR.

LIES totally under the former Muſcle, being as much leſs than the former, as the former is than the Precedent. It ariſeth ſemicircular, broad and fleſhy, from the *Dorſum Ilii*; from hence its fleſhy Fibres deſcend to their tendinous Inſertion at the ſuperiour part of the Root of the great *Trochanter*.

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THE Fibres of this running parallel with thoſe of the former, aſſiſt it in all its Actions. Whatſoever Authors have ſaid concerning a *Rotator Femoris Introrſum*, we are well aſſured, that there is no other Muſcle employ'd in that Action, but the fore Parts of theſe two only. They alſo aſſiſt in rendring the Articulation of the Thigh Bone with the *Coxa* more ſtable, in ſtanding erect.

CLIV.

PYRIFORMIS, *ſeu* ILIACUS EXTERNUS.

Tab. VIII. LVI. LVIII.

RECEIVES its firſt Name from its Figure, the ſecond from its Situation. Its Beginning is round and fleſhy from the inferiour and internal Part of the *Os Sacrum*, in the *Pelvis* of the *Abdomen*; and deſcending obliquely in the great *Sinus* of the *Os Ilium*, above the acute Proceſs of the *Iſchium*, and joining with the *Glutæus Medius*, it is inſerted by a round Tendon into the Root of the great *Trochanter*. This moves the *Os Femoris* ſomewhat upwards, and turns it outwards.

CLV.

MARSUPIALIS, *ſeu* BURSALIS.

Ibid.

SO called from its tendinous running through (as it were) a ſecond fleſhy Beginning of it ſelf, which Duplication repreſents a Purſe: It is alſo called *Obturator Internus* from its Situation upon the great round hole of the *Os Iſchium*, which it fills and ſtops up. It ariſeth broad and fleſhy from part of the *Os Ilium*, *Iſchium*, *Pubis*, and Ligament that is extended in the great *Foramen* of the two laſt named Bones internally, and marching tranſverſly in the *Sinus* of the *Iſchium*, fenced on each ſide by two Proceſſes, the one acute, the other obtuſe, is externally fleſhy, but internally hath three, ſome times four or five Tendons, paſſing in ſo many diſtinct Furrows in the ſaid *Sinus*, like ſo many Cords in a Quadruple Pulley, where it meets with the other fleſhy Beginning, commonly called its *Marſupium*, ariſing from the above-mentioned acute and obtuſe Proceſſes, which joins with the ſaid Tendons at their united Inſertion into the ſuperiour part of the Root of the great *Trochanter*, near the Implantation of the former Muſcle.

RIOLAN * makes two Muſcles of the *Marſupium*; which Error is taken notice of by † *Marchette*.

WHEN this Muſcle acteth, its Inſertion is directed towards that part of the *Iſchium*, over which its Tendons run after the manner of a Pulley, and the *Os Femoris* is thereby turned outwards.

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* *Anthrop. Lib.* 5. *Cap.* 41. † *Anatom. Cap.* 19.

CLVI.

CLVI.

Ibid.

QUADRATUS FEMORIS.

SO called from its Figure. It ariſeth broad and fleſhy from the *Apophyſis* of the *Os Iſchium*, and paſſes tranſverſly, with an equal Breadth and Thickneſs, to its partly fleſhy, and partly tendinous Inſertion at the poſteriour part of the *Os Femoris*, partly below the great *Trochanter*.

THIS aſſiſts the former Muſcle in turning the Thigh-Bone outwards.

N. B. *BY thruſting in your Finger between this and the* Obturator Externus, *lying under it, you'll eaſily raiſe the one and diſcover the other.*

CLVII.

Tab. IX. LVI' LVIII.

OBTURATOR EXTERNUS.

SO called from its Situation, and *Rotator Femoris Extrorſum* from its Uſe. It hath a large fleſhy Beginning from the external Parts of the *Os Iſchium*, *Pubis*, and Membrane, that covers their *Foramen* externally, oppoſite to the Origination of the *Marſupialis*, or *Obturator Internus*, (already deſcribed) and paſſing tranſverſly backwards, leſſens it ſelf, and becomes tendinous at its Inſertion into the Root of the great *Trochanter* of the Thigh-Bone, near the Termination of the laſt named Muſcle. This turns the Thigh outwards.

CLVIII.

Tab. III. VI. IX. LVI. LIX.

TRICEPS.

SO called from its three Heads or Beginnings; the firſt and largeſt of which ariſeth broad and fleſhy from the inferiour Edges and external Parts of the *Os Iſchium* and *Pubis*, where they are joined to each other, lying between the *Semitendinoſus* and the *Gracilis*, and deſcending with an oblique Order of fleſhy Fibres, is inſerted partly tendinous, and partly fleſhy, near an Hands length in Breadth into the *Linea Aſpera* of the Thigh-Bone immediately below the Inſertion of the *Quadratus Femoris*; its inferiour part making a ſtrong round Tendon, inſerted into the ſuperiour part of the internal and lower *Appendix* of the Thigh-Bone. The ſecond Head or Beginning of this Muſcle ariſeth tendinous from the *Os Pubis*, but in its deſcent ſoon becomes fleſhy, and joins with the former, near to its Inſertion into the middle part of the *Linea Aſpera* of the Thigh-Bone. The third and laſt Beginning of this Muſcle ſpringeth from the inferiour part of the *Os*

Os Pubis, between the Origination of its laſt deſcribed Head, and that of the *Pectineus*, and deſcending obliquely, joins with the firſt, near its Inſertion into the *Linea Aſpera* of the Thigh-Bone, immediately above the Termination of the ſecond Head.

THIS moves the Thigh variouſly according to the diverſity of its Beginnings; for the firſt deſcribed Part of it pulls the Thigh-Bone upwards, inwards, and ſomewhat backwards; the ſecond and third Beginnings of it pull it more inwards, and turn it ſomewhat outwards, as when we put our Legs a-croſs each other.

 CHAP.

CHAP. XXXIII.
Of the MUSCLES *of the* LEG.

COLUMBUS * and *Spigelius* † after *Galen* ‡ mention ten Muſcles, which move the *Tibia*, namely, *Membranoſus*, *Sartorius*, *Gracilis*, *Seminervoſus*, *Semimembranoſus*, *Biceps*, *Rectus*, *Vaſtus Externus*, *Vaſtus Internus*, and *Popliteus*. To theſe *Jacobus Sylvius* **, *Laurentius*, and later Authors, add another Muſcle lying between the two *Vaſti*, and call it *Crureus*. Of theſe, we reckon the firſt ſeven, as *Common* both to the Thigh and Leg, ſince they ariſe either from the *Os Ilium*, *Pubis*, or *Iſchium*, and are inſerted into the *Tibia*, or *Fibula*, in moving of which they move the Thigh alſo: The other are *Proper*, ariſing from the *Os Femoris* only, and being inſerted into the *Tibia*.

CLIX.
MEMBRANOSUS.

Tab. I. V. LV. LVII.

SO called from the large membranous Expanſion it is continuous with, incloſing all the Muſcles of the *Tibia* and *Tarſus*; whence it is alſo called *Faſcia Lata*. It hath an acute fleſhy Beginning from the fore part of the Spine of the *Os Ilium*, between the Origination of the *Sartorius* and tendinous Beginning of the *Glutæus Magnus*; and being dilated to a fleſhy Belly, fills the Interſtice made by the firſt of the two laſt named Muſcles and upper part of the *Rectus*, and the fore part of the *Glutæus Medius*. In its oblique Deſcent it becomes tendinous, four Fingers breadth below the great *Trochanter*, whence it paſſes directly over the *Vaſtus Externus* to its proper Termination, at the ſuperiour *Appendix* of the *Fibula*; but in its progreſs thither it is conjoined with the tendinous Expanſion of the *Glutæus Magnus*, which ariſeth from the Spine of the *Os Ilium*, covering the external part of the *Glutæus Medius*. This united Expanſion, or *Faſcia*, embraces all the external Muſcles of the *Tibia*, as well as thoſe of the Thigh-Bone; and deſcending over the *Patella*, comprehends the Muſcles of the *Tarſus*, and joins with the

* *Lib.* 5. *Cap.* 29. † *Lib.* 4. *Cap.* 32. ‡ *De Muſcul.* ** *Iſagog. Anatom. lib.* 5. *cap.* 29.

Ligamentum

Ligamentum Annulare, which retains the Tendons of the Toes and Foot, unleſs it may be ſuppoſed that this *Faſcia Lata* ſhould end at the lower part of the Thigh-Bone, or ſuperiour parts of the *Tibia* and *Fibula*, and that the laſt named Bones ſhould give an Origination to the inferiour part of the ſaid *Faſcia*, which ſeems to be a Matter more of Controverſy than Uſe. When this Muſcle acteth, the Leg and Thigh are drawn outwards. Its tendon being joined with part of the *Glutæus Maximus*, and having a different Series of Fibres interſecting the other, they do thereby compoſe a ſtrong *Involucrum*, as well including all the *Common* Muſcles of the Leg, as covering the *Proper*; whereby they corroborate them in their Action, as the tendinous Expanſion of the *Biceps Cubiti* doth thoſe of the *Carpus* and Fingers.

CLX.

SARTORIUS.

Tab. I. LV. LVI. LIX.

IT receives this Denomination from the Uſe Taylors make of it, in bringing one Leg and Thigh over the other, to ſit croſs-leg'd: It is alſo called *Longiſſimus Femoris*, it exceeding the reſt of the Muſcles of that part in Length, and *Faſcialis*, from its paſſing over the Muſcles of the Thigh and Leg like a Swathe. It ariſeth ſharp and fleſhy from the fore part of the Spine of the *Os Ilium*, cloſe by the former Muſcle; and deſcending obliquely inwards above the *Muſculus Rectus* and *Vaſtus Internus*, and over part of the *Triceps*, of an equal Breadth and Thickneſs, meets with the *Gracilis*, below the middle of the Thigh internally, and deſcending with it, becomes tendinous in its Paſſage over the internal and inferiour Head of the Thigh-Bone, (under a ſtrict Incloſure of the above deſcrib'd *Faſcia Lata)* and is inſerted four Fingers Breadth below the ſuperiour part of the *Tibia*, internally. Its Uſe is declared above.

CLXI.

GRACILIS.

Ibid.

SO called from being the ſlendereſt of theſe Muſcles: It ariſeth ſomewhat broad and tendinous from the *Os Pubis* internally, between the firſt and ſecond deſcribed Heads of the *Triceps*; and in its ſtrait Deſcent in the inſide of the Thigh, its fleſhy Body grows narrow, and becomes tendinous a little above the former Muſcle, and is ſo inſerted (immediately beneath it) into the *Tibia*.

IT aſſiſteth the former Muſcle, in bending the Thigh and Leg inwards.

CLXII.

Tab. V. VII. VIII. LV. LVI. LX.

BICEPS.

OR *Biceps Femoris*, to diſtinguiſh it from that of the *Cubit:* It having two Heads, the ſuperiour and longeſt of which ariſeth with a round Tendon from the Protuberance of the *Iſchium*; in its Deſcent it becomes large and fleſhy, and in above half its progreſs leſſens it ſelf again, where it is joined with its other Head, having a broad, partly tendinous and partly fleſhy Beginning from the *Linea Aſpera* of the *Os Femoris*, immediately below the Termination of the *Glutæus Maximus*; it being thus united, grows tendinous, as it marcheth in a Chanel on the external part of the lower *Appendix* of the *Os Femoris*, becoming perfectly tendinous at its Implantation into the ſuperiour *Epiphyſis* of the *Fibula*.

BESIDES the Office commonly aſſigned to this Muſcle, in bending the *Tibia* together with the two following, it is likewiſe employed in turning the Leg, together with the Foot and Toes, outwards, when we ſit with the Knees bended.

CLXIII.

Tab. VII. VIII. LV. LVI. LX.

SEMINERVOSUS, *ſeu* SEMITENDINOSUS.

WHICH is ſo called from its being half tendinous, and Nerve-like. It ariſeth partly tendinous, and partly fleſhy, from the external part of the Protuberance of the *Os Iſchium*; and preſently being dilated to a large fleſhy Belly, becomes a round Tendon in half its progreſs, which deſcending over the fleſhy Belly of the following Muſcle, marcheth cloſe by the *Gaſterocnemius* on the poſteriour part of the ſuperiour *Appendix* of the *Tibia*, from whence it paſſes forwards to its Inſertion into the ſaid Bone, immediately below the Termination of the *Gracilis*.

THIS with the following Muſcle bend the *Tibia* directly backwards. Its Tendon, together with thoſe of the three former and the following Muſcle, make the Hamſtrings, as they are commonly called.

CLXIV.

Ibid.

SEMIMEMBRANOSUS.

SO called from its being half tendinous and Membrane-like, lying immediately under the former Muſcle. It ariſeth broad and tendinous from the Protuberance of the *Os Iſchium*; in its Deſcent it becomes broader, and in leſs than half its progreſs begins to grow fleſhy, (where the Belly of the former Muſcle leſſens it ſelf) and is dilated into a large and fleſhy Belly, lying under the long round Tendon of the former, becoming a ſhort thick Tendon inſerted into the ſuperiour part of the upper *Appendix* of the *Tibia* backwards.

N. B. THAT the fleſhy Belly of the former Muſcle is above, and that of this is below, and their Tendons on the contrary.

CLXV.

POPLITEUS.

Tab. VIII. IX. LVI. LX.

BY ſome called *Subpopliteus,* ariſeth with a ſhort, ſtrong Tendon, from a *Sinus* in the external Head of the inferiour *Appendix* of the *Os Femoris*; from whence deſcending obliquely over the Juncture, it becomes fleſhy, and expanding itſelf, is ſo inſerted into the ſuperiour part of the *Tibia* internally, immediately below its ſuperiour *Appendix*. This doth not only aſſiſt the three former Muſcles in bending the *Tibia,* but antagonizeth the *Biceps* by turning the Foot and Toes inwards.

CLXVI.

RECTUS FEMORIS.

Tab. I. II. LV. LXI.

IS named from its ſtreight Progreſs and Situation; it ariſeth fleſhy from a Tubercle of the *Os Ilium,* that is in the mid-way between the fore part of its Spine and the *Acetabulum,* as likewiſe from the Margin of the *Acetabulum*; from whence deſcending directly between the two following Muſcles, and over the *Crureus,* its Fibres externally deſcend from a middle Line obliquely, laterally; internally they run according to its Length, and become entirely tendinous, four Fingers breadth above the *Patella,* where it is united with the Tendons of the three following Muſcles, and inſerted together with them at the upper part of the *Tibia.*

CLXVII.

VASTUS EXTERNUS.

Ibid.

SO called from its Magnitude and Situation; it ariſes outwardly tendinous, and inwardly fleſhy, from the external part of the great *Trochanter* and the *Linea Aſpera* of the Thigh-Bone, from whence its Fibres deſcend obliquely forwards, and on the contrary become outwardly fleſhy, and tendinous internally; and ſo ſoon as they meet with the Tendon of the former Muſcle, grow perfectly tendinous, and join with it, and thoſe of the two following.

CLXVIII.

VASTUS INTERNUS.

Ibid.

THIS like the former hath its Denomination from its Situation and Magnitude: Its Beginning is large, partly tendinous, and partly fleſhy; it being continued from the *Linea Aſpera* on the back part of the Thigh-bone, from immediately below the leſſer *Trochanter,* till within three Fingers breadth above the

inferiour

inferiour *Appendix* of the ſaid Bone internally, and laterally; from hence its fleſhy Fibres deſcend obliquely outwards, in an almoſt ſemicircular manner, and on a ſudden (like the former Muſcles) ceaſing to be fleſhy, its Tendon is united with that of the *Rectus*, together with the former and following Muſcles, and inſerted with them.

CLXIX.

CRUREUS, *ſeu* FEMOREUS.

Tab. II. VI. LVI. LXI.

SO called from its Situation on the Bone of the Thigh, like the *Muſculus Brachiæus*, on that of the Arm: Its Origination is large and fleſhy, being continued from between the greater and leſſer *Trochanter* of the Thigh-Bone forwards, to its lower part, that is immediately above its inferiour *Appendix*; hence its fleſhy Fibres deſcending directly, become perfectly tendinous, a little below the upper part of the Tendon of the *Rectus*, where it joins with it and the Tendons of the two laſt deſcribed Muſcles, and paſſes over the external part of the *Patella*, (or on each ſide of it) and is inſerted into a Prominence at the ſuperiour and fore part of the *Tibia*.

THESE four Muſcles laſt treated of, *viz. Rectus, Vaſtus Externus, Vaſtus Internus*, and *Crureus*, may be eſteemed one, in regard they make but one Tendon at their Inſertion, and ſerve for the ſame Uſe in extending the *Tibia*, or Leg, however they are divided into ſeveral Bodies, and one of them is incloſed on all ſides by the *Faſcia Lata*, namely the *Rectus*, and in themſelves they have a multiform *Series* of fleſhy Fibres, whereby they are render'd capable of performing their Office with greater Strength, which is abſolutely neceſſary, not only in Running, Walking, Leaping, &c. but in Standing, to keep the Body erect, by oppoſing that Flexure at the Knee, which muſt otherwiſe neceſſarily happen through the ſuperincumbent Preſſure made by the whole Body. For this reaſon likewiſe we find theſe extending Muſcles in ſo great a proportion larger than their Antagoniſts the Benders, which appeared by their Weight, when at the Requeſt of my very good Friend Dr. *Brown*, (then Reader on the Muſcular Diſſections at Chirurgeons-Hall) theſe extending Muſcles were weighed, and likewiſe their Antagoniſts the Benders in the ſame Body, whereby we found the former exceeded the latter two Pounds wanting an Ounce; the former, namely the *Extenſores*, weighing three Pounds ſix Ounces, and their Antagoniſts the latter but one Pound ſeven Ounces. In another Body the Extenders weigh'd four Pounds, eight Ounces and a half, and the Benders but two Pounds two Ounces. Beſides which, the Extenders have ſtill a farther Advantage given them by Nature: For, by having a Bony Subſtance, as the *Patella*, placed between them and the Inſertion of their Tendon, their Line of Direction is farther removed from the Center of Motion, and conſequently they act with greater Strength in antagonizing the Benders, than they could otherwiſe have done.

CHAP.

Chap. XXXIV.

Of the MUSCLES *of the* Foot, *or* Tarsus.

THE Foot has ſeven Muſcles properly employ'd in its Motions, among which is reckon'd the *Plantaris:* But *Columbus* *, *Falloppius* †, and other Anatomiſts, reckon eight Muſcles belonging to each Foot, rejecting *Veſalius* his ninth, it being part of the *Extenſor Digitorum Longus*, that is inſerted into the Metatarſal-Bone of the little Toe. Notwithſtanding which we chooſe to follow ‡ *Spigelius*, ** *Veſlingius*, and the later Authors, making of their two firſt the *Gaſterocnemius Externus* and *Gaſterocnemius Internus* only one Muſcle, giving it the Name of *Gaſterocnemius Externus*, and calling its ſubjacent Muſcle *Gaſterocnemius Internus*, which former Anatomiſts had named *Soleus*.

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* *Lib.* 5. *Cap.* 30. † *Obſervat. Anatom.* ‡ *Lib.* 4. *cap.* 24. ** *Cap.* 19.

CLXX.

Tab. LV. LVI. LXI.

TIBIALIS ANTICUS.

SO called from its Situation on the fore part of the *Tibia*; alſo by *Spigelius* called *Muſculus Catenæ*, becauſe, when it is divided, the Patient is forced to uſe a Sling to ſupport the Foot in walking. Its Origination is fleſhy from the lower part of the ſuperiour Appendage of the *Tibia*, between its Prominence, where the great Tendon of all the extending Muſcles of the Leg is inſerted, and the Origination of the *Muſculus Extenſor Magnus Digitorum Pedis:* It alſo continues a diſgregated fleſhy Origination from near two thirds of the ſuperiour part of the ſaid *Tibia* externally and laterally, next the *Fibula*; which compoſing a fleſhy Belly, leſſens itſelf in half its Progreſs; and growing into a ſtrong and ſomewhat round Tendon, deſcends obliquely over the inferiour part of the *Tibia*, and under the annular Ligament, and is inſerted partly into the inſide of the *Os Cuneiforme Majus*, but chiefly into the *Os Metatarſi Pollicis*.

THIS pulls the Foot upwards and forwards directly.

CLXXI.

Tab. LV. LXII.

GASTEROCNEMIUS EXTERNUS, *ſeu* GEMELLUS.

SO called, becauſe with the *Soleus*, or *Internus* of the ſame Name, it compoſes the Calf of the Leg: It is alſo called *Gemellus*, from its being as it were double. It has two diſtinct fleſhy Originations, from the ſuperiour and hindmoſt Parts of each Tubercle of the lower Appendage of the Thigh-Bone, which in their Deſcent are dilated into two large fleſhy Bellies, the innermoſt of which is thickeſt and largeſt, having each a differing *Series* of fleſhy Fibres, and joining to each other near where they make a broad ſtrong Tendon, which narrowing it ſelf, joins with the great Tendon of the *Gaſterocnemius Internus*, four Fingers breadth above its Inſertion into the *Os Calcis*.

RIOLAN * aſſerts, with *Veſalius*, that in the two Beginnings of this Muſcle there are two *Oſſicula Seſamoidea*, which we muſt acknowledge with *Marchette* have hitherto eſcaped our Obſervation, tho' its likely it may be ſo in aged Bodies, as it appear'd in a Subject I lately diſſected on one ſide only.

WHEN this Muſcle acts, the Foot is ſaid to be extended, or pulled backwards; which Motion of it is very neceſſary in Walking, Running, Leaping, and ſtanding on Tiptoe, &c. Hence it is, thoſe that walk much, have theſe Muſcles larger than others, through the frequent uſe of them, among which thoſe that carry heavy Burthens, and eſpecially Sedans or Chairs in this Town; and thoſe, who wear low-heeled Shoes, have theſe Muſcles remarkably larger than others.

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* *Lib.* 5. *Cap.* 43.

CLXXII.

CLXXII.

PLANTARIS.

Tab. VIII. LXII. LXV.

SO called from its Tendon expanded in the *Planta Pedis*, like that of the *Palmaris* in the Palm of the Hand. It ariſes fleſhy from the ſuperiour and back part of the outermoſt Tubercle of the lower Appendage of the Thigh-Bone, immediately under the external Beginning of the former Muſcle; and deſcending obliquely between it and the following Muſcle, ſoon becomes a thin flat Tendon, which paſſing out from between their fleſhy Bellies, deſcends internally laterally by their great Tendon; and marching cloſe over the *Os Calcis*, joins with other Tendons ariſing from the *Os Calcis*; all which expand themſelves on the Sole of the Foot, where they firmly adhere to the fleſhy Body of the *Muſculus Flexor Digitorum Perforatus*; ſome of them ending on the upper Parts of the *Oſſa Metatarſi*, and others on both ſides the Extremities of theſe Bones, where the Toes are articulated.

WHEN this Muſcle acts, it aſſiſts the *Gaſterocnemii*, and its tendinous Expanſion on the bottom of the Foot ſerves to defend the ſubjacent Muſcles, Tendons, Nerves, and large Blood Veſſels, from being too much compreſs'd in ſtanding, walking, &c. I have frequently obſerv'd the fleſhy Beginning and long Tendon of this Muſcle to be wanting.

BESIDES this tendinous Expanſion on the bottom of the Foot, I lately obſerv'd a ſmall Tendon, or Ligament, ariſing from the *Os Metatarſi* of the little Toe, and faſtned to the Bone of the ſame Name, that ſupported the middle Toe; but in this Foot there was no *Muſculus Tranſverſalis*.

CLXXIII.

SOLEUS, *ſeu* GASTEROCNEMIUS INTERNUS.

Tab. V. VII. VIII. LV. LXII.

THIS is placed under the two former Muſcles. Its external fleſhy Part is cover'd with a tranſparent tendinous Expanſion, which makes it appear of a livid Colour. Its Beginning is partly tendinous, but chiefly fleſhy, from the hindmoſt part of the upper *Appendix* of the *Fibula*, and back part of the *Tibia*, below the Inſertion of the *Subpopliteus*, and increaſes to a large fleſhy Belly, compoſed of various Orders of fleſhy Fibres, ſome of them underneath aptly expreſſing the Figure of the top of a Feather, whoſe *Stamina* here being tendinous, join with the great Tendon, which is about four Fingers breadth in Length, and inſerted into the ſuperiour and hindmoſt part of the *Os Calcis*.

THE Foot, together with the Toes, being as it were a Leaver to the whole Body, ought therefore to be attended with Muſcles of great Strength to extend it; wherefore we find theſe Muſcles ſo much to exceed their Antagoniſt the *Tibialis Anticus*, as well in the advantagious Conſtruction of their differing Series of fleſhy Fibres,

Fibres, as their Magnitude, the *Tibialis* weighing only five Ounces and a Quarter, whereas the two *Gasterocnemii* weigh one Pound ten Ounces; whereby they are not only render'd serviceable in Walking, Running, Leaping, &c. but do also support the *Tibiæ* in Standing, lest the superincumbent Pressure of the Weight of the Body should make them incline forwards, at their Articulations with the *Talus*.

CLXXIV.

Tab. V. VIII. IX. LV. LVI. LXII. LXVI.

PERONÆUS PRIMUS.

BY some called *Longus*, it being the longest Muscle seated on the *Fibula*, or *Os Perone*. It arises externally tendinous, and fleshy internally, from above half the superiour part of the said Bone; and marching somewhat backwards, becomes a strong, flat Tendon, four Fingers breadth in Length above the inferiour Appendage of the *Fibula* called *Malleolus Externus*, passing behind which in a Chanel, like a Rope in a Pully; and from thence being inflected forwards, together with the Tendon of the following Muscle, they both pass under an imbanding Ligament, as they run over the *Os Calcis*; but this Tendon declining from its Companion, marches over the *Os Cuboides*, under the *Musculus Abductor Minimi Digiti*, over the *Ossa Cuneiformia* in the bottom of the Foot, and under the Tendons and Muscles bending the Toes, and is inserted into the superiour and hindmost part of the *Os Metatarsi* of the great Toe.

Tab. LXII. N. *Tab.* LXVI. * IN the Tendon of this Muscle is found a Bony Substance, which moves on the *Os Cubiforme*, not unlike the *Patella* of the Knee.

THE Passage of the Tendon of this Muscle over the hindmost part of the *Malleolus Externus*, as on a Pulley, is an elegant contrivance in Nature, whereby the Ball of the great Toe (as that part is commonly called, to which it is inserted) is directed towards a perpendicular bearing of the weight of the Body on the Leg, in standing on Tiptoe.

CLXXV.

Tab. V. LV. LVI. LXII.

PERONÆUS SECUNDUS.

BY some called *Semi-fibulæus:* It has an acute fleshy Beginning above the middle of the external part of the *Fibula*, under the fleshy Belly of the former Muscle; it also continues its fleshy Beginning from the posteriour sharp edge of the *Fibula*, and becoming a fleshy Belly grows tendinous, as it runs under the *Malleolus Externus*, together with the Tendon of the former Muscle, and is inserted into the superiour and external part of the *Os Metatarsi* of the little Toe.

THE proper Action of this Muscle is to pull the Foot and Toes outwards.

CLXXVI.

CLXXVI.

TIBIALIS POSTICUS.

Tab. IX. LVI. LXII. LXVI.

THIS being placed on the back part of the *Tibia*, is alſo called *Muſculus Nauticus*, becauſe Mariners chiefly uſe it in climbing up the Maſts of their Ships. It lies partly under the *Flexor Tertii Internodii Pollicis*, which Muſcle muſt be partly raiſed, together with the *Flexor Tertii Internodii Digitorum Pedis*, before we can have a clear Sight of it. It appears Biventral, ariſing partly tendinous and partly fleſhy from the ſuperiour and back part of the *Fibula*, as alſo from the Ligament that is continued between the ſaid Bone and the *Tibia*; in near half its Progreſs it becomes leſs, and grows fleſhy again, making a ſtrong, flat Tendon, which runs in a *Sinus* on the back part of the lower Appendage of the *Tibia*, called the *Malleolus Internus*, under an annular Ligament, over the *Os Naviculare*, to which it is tack'd down by ſome tendinous Fibres, and ends internally and laterally on the *Os Cuneiforme Majus*.

THIS draws the Foot upwards and inwards.

IN the Tendon of this Muſcle, as in that of the *Peronæus Primus*, I have frequently found a Bony Body, juſt where it marches over the *Os Naviculare*.

CHAP.

Chap. XXXV.
Of the MUSCLES *of the* Great Toe.

THE great Toe is moved by its proper Muſcles, which we reckon to be ſix in number, namely, *Extenſor Pollicis Longus*, and *Extenſor Brevis*, *Flexor Pollicis Longus*, and *Flexor Brevis*, *Adductor* and *Abductor Pollicis*. Though Anatomiſts commonly mention but four of theſe, yet we have obſerv'd them in ſeveral Diſſections to be ſo many diſtinct Muſcles, as they are accurately figured in *Bidloo* *. To theſe may be added the *Muſculus Tranſverſalis Placentini*, which our above-mention'd Author and ſome other make to be an *Adductor Pollicis;* but we take it rather to be an *Adductor Minimi Digiti*, wherefore it ſhall be deſcribed in the following Chapter.

CLXXVII.

Tab. I. II. V. LVI. LXIII.

Extensor Pollicis Longus.

THIS Muſcle doth not ariſe, as moſt deſcribe it, from the *Tibia*, or from the Ligament between it and the *Fibula*. Its Beginning is large and fleſhy from the fore part of the *Fibula*, from immediately below its ſuperiour *Appendix*, to four Fingers Breadth above the inferiour one, and deſcending under the *Ligamentum Annulare* of the *Tarſus*, between the Tendon of the *Tibialis Anticus* and thoſe of the *Extenſor Digitorum Pedis Longus*, and marching along the ſuperiour part of the Foot, it is inſerted into the upper part of the ſecond Bone of the great Toe.

Its Name intimates its Uſe.

This Muſcle, juſt where it paſſes under the annular Ligament, ſends off a ſmall Tendon, which is inſerted into the upper part of the firſt Bone of the great Toe externally and laterally, as has been frequently obſerv'd and demonſtrated by that inquiſitive and accurate Anatomiſt, Mr. *Joſeph Tanner*.

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* *Tab.* 81. & 82.

CLXXVIII.

EXTENSOR POLLICIS BREVIS.

Tab. I. VI. LV. LVI. LXIII.

THOUGH this Mufcle is not mentioned by Anatomifts, yet we conftantly obferve it in Diffection. It hath been commonly taken for part of the *Extenfor Digitorum Brevis*; but we frequently find it diftinct.

IT arifeth flefhy from the fore part of the *Os Calcis*, and being dilated into a flefhy Belly, foon becomes a long, flender Tendon, paffing obliquely over the upper part of the Foot, and is inferted into the fuperiour part of the firft Bone of the great Toe, which it extends or pulls upwards.

CLXXIX.

FLEXOR POLLICIS LONGUS.

Tab. VIII. LVI. LXIII. LXV. 4. 4. LXVI.

THIS is an Antagonift to the *Extenfor Longus*; arifing oppofite to it from the back part of the *Fibula*, with a double Order of flefhy Fibres, running to a middle Tendon, like the *Flexor Tertii Internodii Pollicis Manus* above. It ceafeth to be flefhy as it paffes over the Juncture, and runs through a Chanel on the internal part of the *Os Calcis*, under the Tendon of the *Mufculus Flexor Digitorum Longus Perforans*, to which Tendon it fends off a flefhy Slip over the following Mufcle, and is inferted into the upper end of the fecond Bone of the great Toe.

CLXXX.

FLEXOR POLLICIS BREVIS.

Tab. LXIV. LXV. LXVI.

IS fhort, thick, and flefhy, feemingly divided into two Mufcles by the Tendon of the former paffing over it. It arifeth from the fuperiour part of the *Os Cuneiforme medium*, and running over the Termination of the *Mufculus Peronæus Primus*, is implanted into the *Offa Sefamoidea* of the great Toe, which are likewife tied to the fuperiour part of the fecond Bone of that Toe.

CLXXXI.

ADDUCTOR POLLICIS.

Tab. LXIV. LXVI.

THIS is defcrib'd and figur'd by * *Vefflingius*, and alfo mention'd by *Marchette*. It arifes with a broad, flat Tendon, from the *Os Calcis*, immediately under the *Mufculus Communis Lumbricalis*, and in half its Progrefs on the bottom of the Foot, it becomes flefhy, juft after it paffes over the Tendon of the *Peronæus Longus*, where it meets with another Beginning partly flefhy, and partly

* *Cap.* 19.

tendinous, from the inferiour part of the *Os Cuneiforme Tertium*; after which it marches obliquely to its Inſertion into the inner *Os Seſamoideum* of the great Toe.

THIS draws the great Toe nearer to the reſt.

CLXXXII.

Tab. LXIV. LXV.

ABDUCTOR POLLICIS.

THIS ariſeth fleſhy from the *Os Calcis* internally and laterally; in half its Progreſs becoming tendinous, it joins with another fleſhy Beginning, ſpringing from the *Os Cuneiforme Majus*; both which making one Tendon, join with the *Flexor Pollicis Brevis*, before they are inſerted into the external part of the firſt Bone of the great Toe laterally.

THIS pulls the great Toe from the reſt.

CHAP. XXXVI.
Of the MUSCLES *of the* FOUR LESSER TOES.

THESE (like the Muſcles of the Fingers) we ſhall divide into *Common* and *Proper*.

THE *Common* Muſcles of the Toes are ſuch, as have their Tendons inſerted into all the leſſer Toes, as the *Extenſor Digitorum Pedis Longus*, *Extenſor Brevis*, *Perforatus*, and *Perforans*. The reſt are the *Proper* Muſcles of the Toes, namely, *Lumbricales*, *Abductor Minimi Digiti*, *Tranſverſalis Placentini*, *Flexor Primi Internodii Minimi Digiti Proprius*, and the *Interoſſei*. Of theſe in their Order.

CLXXXIII.
EXTENSOR DIGITORUM PEDIS LONGUS. *Tab.* II. V. LV. LVI. LXIII.

THIS hath an acute fleſhy Beginning externally from the inferiour part of the upper *Appendix* of the *Tibia* next the *Fibula*; as alſo a long fleſhy one from the ſuperiour part of the laſt named Bone; and leſſening it ſelf in half its Deſcent on the Leg, it joins with a ſecond, broad, diſgregated fleſhy Beginning, continued for near half the inferiour part of the ſaid *Fibula*; where deſcending under the *Ligamentum Annulare* of the *Talus*, it is divided into five Tendons, four of which are inſerted into the third Bones of all the leſſer Toes; the fifth into the ſuperiour part of the *Os Metatarſi* of the little Toe, which Part of it *Veſalius* * makes his ninth Muſcle belonging to the Foot.

* *Lib.* 2. *Cap.* 60.

CLXXXIV.

Tab. V. VI. LV. LVI. LXIII.

EXTENSOR DIGITORUM BREVIS.

THIS is a ſhort fleſhy Muſcle, lying under the Tendon of the former, on the Foot. It ariſeth fleſhy from the external and fore part of the *Os Calcis*, ſoon dilating it ſelf to a fleſhy Belly; which being divided into four fleſhy Portions, becomes ſo many Tendons, paſſing over the upper part of the Foot, and joining with the Tendons of the former Muſcle, as they paſs to their Inſertions into the third Bone of each of the leſſer Toes.

CLXXXV.

Tab. LXIII. LXV.

PERFORATUS.

SO called, becauſe its Tendons are perforated, like thoſe of the Fingers. It is alſo called *Flexor Secundi Internodii Digitorum Pedis*, from its Uſe, and *Sublimis* from its Situation. It ſpringeth from the inferiour and internal Part of the *Os Calcis*, between the *Muſculi Abductores* of the greater and leſſer Toes. Dilating it ſelf to a fleſhy Belly, after it hath paſſed the middle of the *Planta Pedis*, it is divided into four fleſhy Portions, which become ſo many Tendons, and are divided near their Terminations, to admit the Tendons of the following Muſcle to paſs through them to their Inſertions; theſe being united again, paſs underneath the other to their Implantations at the upper part of the ſecond Bone of each leſſer Toe.

CLXXXVI.

Tab. VIII. LV. LVI. LXIII. LXV. LXVI.

PERFORANS.

SO called, becauſe its Tendons run through the Fiſſures in the Tendons of the former: It is alſo called *Flexor Tertii Internodii Digitorum Pedis* from its Uſe. It hath an acute fleſhy Origination from the back part of the *Tibia*, immediately under the *Muſculus Subpopliteus*, having a double Order of Fibres united in a middle Tendon, like the *Flexor Pollicis Longus*, but ceaſeth to be fleſhy, as it paſſeth behind the *Malleolus Internus*; and running in a Chanel over the internal Part of the *Os Calcis*, under its imbanding Ligaments, in half its Progreſs through the ſole of the Foot, it is divided into four Tendons, which march through the Perforations of the Tendons of the former Muſcle, and are inſerted into the third Bone of every leſſer Toe.

CLXXXVII.

LUMBRICALES.

Tab. LXIII. LXV. LXVI. *f*, 6.

SO called from their Figure, like thoſe of the Hand. Though Anatomiſts have generally deſcrib'd them as ariſing from the Tendons of the laſt treated of Muſcle, yet we rather think the *Carnea Maſſa* in the *Planta Pedis* is their true Origine. It ſprings from the internal Part of the *Os Calcis*, and becoming tendinous, joins with the Tendons of the former Muſcle, in the middle of the Sole of the Foot; then dividing it ſelf into four (as it were) diſtinct fleſhy Muſcles, they all become tendinous at their Inſertions into the internal Parts of each leſſer Toe laterally, next the great Toe.

CLXXXVIII.

ABDUCTOR MINIMI DIGITI.

Tab. LV. LXIV. LXV.

ARISES outwardly tendinous, and inwardly fleſhy, from the external part of the *Os Calcis*; and becoming entirely tendinous in half its Progreſs on the bottom of the Foot, paſſes over a ſmall fleſhy Muſcle, which I call *Flexor Primi Internodii Minimi Digiti Proprius*, and is afterwards inſerted into the firſt Bone of the little Toe externally and laterally.

CLXXXIX.

TRANSVERSALIS PEDIS.

Tab. LXIV.

SO called from its tranſverſe Situation. It ariſes tendinous from the internal *Os Seſamoides* of the great Toe; and becoming a fleſhy Belly in its Progreſs over the Metatarſal Bones of the two next Toes, grows broader, where it joins with a tendinous Ligament ſpringing from the *Os Calcis*, and is inſerted into a Cartilage on the firſt Articulation of the third leſſer Toe, ſending ſome fleſhy Fibres likewiſe to the little Toe.

Its Uſe is to bring the leſſer Toes nearer to the great Toe.

CXC.

FLEXOR PRIMI INTERNODII MINIMI DIGITI PROPRIUS.

Tab. LXIV. LXV.

IS a ſhort fleſhy Muſcle, ſpringing from the *Os Metatarſi Minimi Digiti*, and paſſing directly to its Inſertion into the firſt Bone of the little Toe. In its Tendon are contained two *Oſſa Seſamoidea*.

Though this is a diſtinct Muſcle, it has been commonly look'd on as a part of the *Abductor Minimi Digiti*; but, if you raiſe the laſt named Muſcle from its Origine, you will not find any Connexion between it and this.

CXCI.

Tab. LXIV. LXVI.

Interossei Pedis.

ARE eight ſmall fleſhy Muſcles, ariſing from the *Oſſa Metatarſi* of the leſſer Toes. Theſe are all alike in their Origine, Progreſs and Inſertion, filling the concave inferiour Surface of the Metatarſal Bones. Each of them becoming a Tendon, which has an *Os Seſamoides* placed in it, unites with its Fellow on the oppoſite Side, having one common inſertion into the ſuperiour and under part of the firſt Internode of the Toe.

When theſe Muſcles act together, they bend the Toes: When they act ſeparately, thoſe that are placed on the inſide of each leſſer Toe, draw the leſſer Toes towards the great Toe, and the oppoſite ones pull them the contrary way.

EXPLANATION

OF THE

TABLES.

TAB. I.

Represents the Muscles appearing on the fore Side of a human Body, after the external Teguments are removed.

a The Parotide Gland.
c The Maxillary Gland.

TAB. II.

The same Body, with some of the external Muscles raised, and others taken off.

TAB. III.

Shews the same Body farther denuded.

A *a* B Three Perforations in the Diaphragm, for
A The *Vena Cava*,
a The *Oesophagus*,
B The *Aorta*.


21
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2
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152
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TAB. III.

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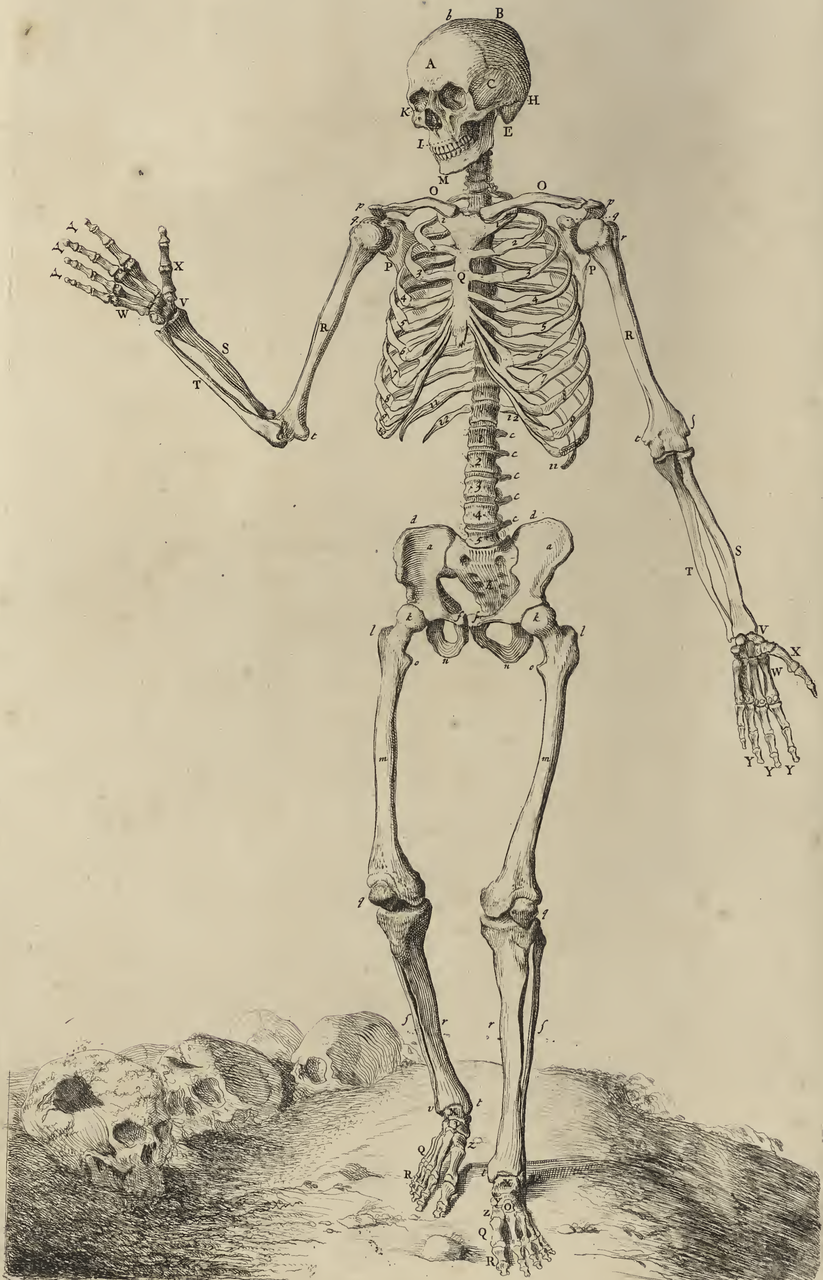
A
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b
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p
q
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Q
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O

TAB. IV.

Shews the fore Part of the Skeleton of a Man.

A *Os Frontis.*
B *Os Sincipitis.*
b The meeting of the Coronal and Sagittal Sutures.
C *Os Temporum.*
E The Maſtoide Proceſs.
H *Os Jugale.*
I The upper Jaw-Bone.
K The Bones of the Noſe.
M The lower Jaw-Bone.
O The Clavicle.
P The *Scapula.*
p *Acromium.*
q *Proceſſus Coracoides.*
Q *Sternum.*
R *Os Humeri.*
r A *Sulcus*, in which paſſes one of the Heads of the *Biceps.*
ſ The outer Protuberance of the *Humerus*, from which ariſe the Muſcles extending the Wriſt and the Fingers.
t The inner Protuberance, whence the Benders of the Wriſt and Fingers ariſe.
S The *Radius.*
T The *Ulna.*
V The Bones of the *Carpus.*
W of the *Metacarpus.*
X of the Thumb.
Y of the Fingers.
1, 2, 3, &c. The twelve Ribs.
1, 2, 3, 4, 5. The *Vertebræ* of the Loins.
c, c, c, c, c. Their tranſverſe Proceſſes.
a *Os Ilium.*
d Its Spine.
h *Os Sacrum.*
f *Os Pubis.*
n *Iſchium.*
m The Thigh-Bone.
k Its Head.
l The great *Trochanter.*
o The leſſer *Trochanter.*
q The *Patella.*
r The *Tibia.*

ſ The *Fibula*.
t The inner Ankle.
v The outer Ankle.
x The *Aſtragalus*.
y *Os Naviculare*.
z *Os Cuneiforme*, that joins the *Os Metatarſi* of the great Toe.
O *Os Cuneiforme* of the ſecond Toe.
Q The Bones of the *Metatarſus*.
R The Bones of the Toes.


I.
II.

TAB. V.

Represents the Body in a Side View.

FIG. I.

A The *Os Jugale.*
C The Parotide Gland.
D The Submaxillary Gland.
G The Clavicle.
H The *Acromium.*
m The *Olecranum.*
n The lower Extremity of the *Ulna.*
♀ The annular Ligament of the *Carpus.*
N A large Branch of the Brachial Nerve, which paſſes in a Chanel on
P The inner Protuberance of the *Os Humeri.*
Q The Spine of the *Os Ilium.*
R The great *Trochanter.*
Y The Inſertion of the *Sartorius, Gracilis,* and *Semitendinoſus* in the *Tibia.*
Z The lower *Appendix* of the *Fibula,* or the outer Ankle.
* The lower *Appendix* of the *Tibia,* or the inner Ankle.
♀ The Ligament, under which paſs the Tendons of the *Tibialis Anticus,* and *Extenſor Longus Digitorum Pedis.*

FIG. II.

A The *Os Jugale.*
B The Maſtoide Proceſs bared.
E Part of the lower Jaw laid bare.
F The internal Jugular Vein.
G The Clavicle.
H The Spine of the *Scapula.*
I The *Sternum.*
K The *Proceſſus Coracoides,*
L The upper Part of the *Os Humeri* laid bare.
l The outer Protuberance of the *Humerus* bared.
M Part of the *Ulna.*
m The *Olecranum.*
n The lower Extremity of the *Ulna.*
o The Head of the *Radius.*
N The Nerve, and
P The *Sulcus,* as in the preceding Figure.

Q The

Q The Spine of the *Os Ilium.*
R The great *Trochanter.*
S The *Os Sacrum.*
T The obtuſe Proceſs of the *Iſchium.*
V The Trunk of the crural Nerve.
X The *Patella.*
Y The upper Part of the *Tibia* bared.
y The Blood Veſſels paſſing between the Bones.
Z The outer Ankle.
* The inner Ankle.


II
I

TAB. VI.

Represents the Side View of the Body partly denuded, and of the Skeleton.

FIG. I. II.

A The *Os Frontis.*

B The *Bregma.*

C The *Os Temporale.*

D The *Os Occipitis.*

E *Processus Mammillaris.*

F *Processus Styloides.*

G *Meatus Auditorius.*

I *Maxilla Superior.*

a a The semicircular Asperity of the *Os Bregmatis*, from which the temporal Muscle arises.

FIG. II.

H *Os Jugale.*

K *Os Nasi.*

L Part of the Sphenoidal Bone.

M The lower Jaw-bone.

b The Union of the Sagittal and Coronal Sutures.

c The Rise of the Occipital Muscle.

e The *Processus Corone.*

f The *Processus Condyloides.*

N The Bodies of the *Vertebræ Colli.*

1, 2, *&c.* 9. Their Spinal Processes, with those of the two uppermost of the Back.

O The *Clavicula.*

P The *Scapula.*

p The *Acromium.*

q The *Processus Coracoides.*

Q The *Sternum.*

R The *Humerus.*

r The *Sulcus*, in which runs the Tendon of one Head of the *Biceps.*

s The outer Protuberance of the *Humerus.*

t The inner Protuberance.

S The *Radius.*

T The *Ulna.*

V The Bones of the *Carpus.*

W The *Metacarpus.*

X The Bones of the Thumb.

Y of the Fingers.

 The

1, 2, 3, &c. The twelve Ribs.
b The Bodies of the *Vertebræ Lumborum.*
c, c, c. Their Spinal Proceſſes.
d The Spine of the *Os Ilium.*
f The *Oſſa Pubis.*
g The *Os Iſchium.*
h The *Os Sacrum.*
i *Os Coccygis.*
k The Head of the *Os Femoris.*
l The great *Trochanter.*
m The Thigh Bone.
o The *Linea Aſpera.*
p The lower *Appendix*, with its two Heads, from which the *Gaſterocnemius* and *Soleus* ariſe.
q The *Patella.*
r The *Tibia.*
ſ The *Fibula.*
t The lower *Appendix* of the *Tibia*, or the inner Ankle.
v The lower *Appendix* of the *Fibula*, or the outward Ankle.
w The *Os Calcis.*
x The *Aſtragalus.*
y The *Os Naviculare.*
Z, O The *Oſſa Cuneiformia.*
p The *Os Cuboides.*
Q *Oſſa Metatarſi.*
R The Bones of the Toes.

FIG. III. IV.

L Part of the Sphenoidal Bone.
d The *Meatus Auditorius.*

TAB.

TAB. VII.


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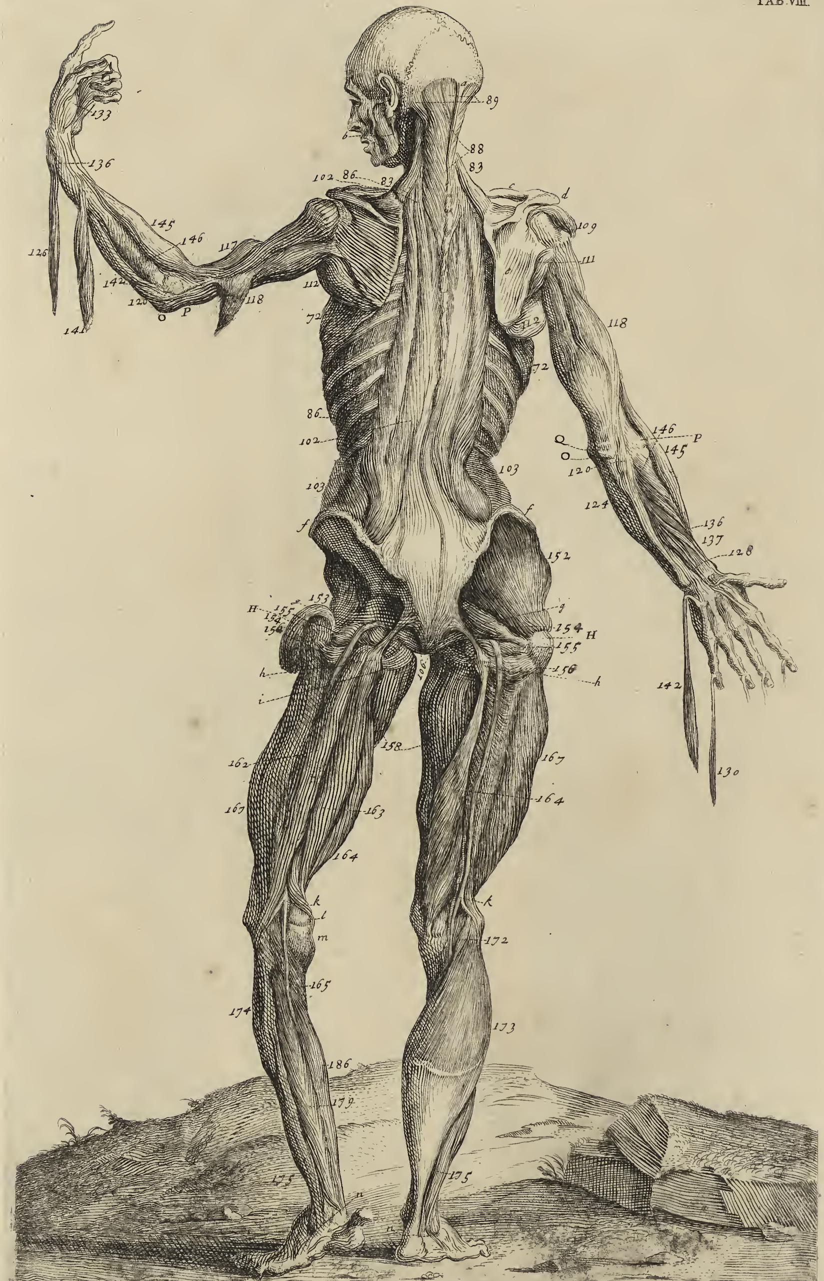
TAB. VIII.



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TAB. VII.

Shews the back View of the Body of a Man.

TAB. VIII.

The ſame Body with ſome of the external Muſcles taken off.

a The Riſe of the *Ligamentum Colli* from the *Os Occipitis.*
b The lower Jaw-bone partly bared.
c The *Clavicula.*
d The *Acromium.*
e The *Scapula.*
O The *Olecranon.*
P The outer, and
Q The inner Protuberance of the *Os Humeri.*
f The Spine of the *Os Ilium.*
g The Ligament between the obtuſe Proceſs of the *Iſchium* and the *Os Sacrum.*
H The great *Trochanter.*
h The obtuſe Proceſs of the *Iſchium.*
i Part of the *Os Iſchium* laid bare.
k The Trunk of the Crural Nerve.
l The inner Head of the lower *Appendix* of the Thigh Bone.
m The Head of the *Tibia.*
n The outer Ankle.

TAB. IX.

Represents the same Body, with more of the Muscles removed.

a The Rise of the *Ligamentum Colli* from the *Occiput*.
c The *Clavicula*.
d The *Acromium*.
e The *Scapula*.
o The Olecranon.
P The outer, and
Q The inner Protuberance of the *Humerus*.
R The Ligament between the *Radius* and *Ulna*.
f The Spine of the *Os Ilium*.
h The acute Process of the *Ischium*.
L The obtuse Process of the same Bone.
g The *Os Sacrum*.
o The *Os Coccygis*.
i The Head of the *Os Femoris* cover'd with the *Ligamentum Latum*.
k The great *Trochanter*.
⊙ The Crural Artery.
l The *Tibia*.
m The *Fibula*.
n The *Calcaneus*.


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P
Q
O
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R
f
f
127
157
106
k
h
k
L
L
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l
m
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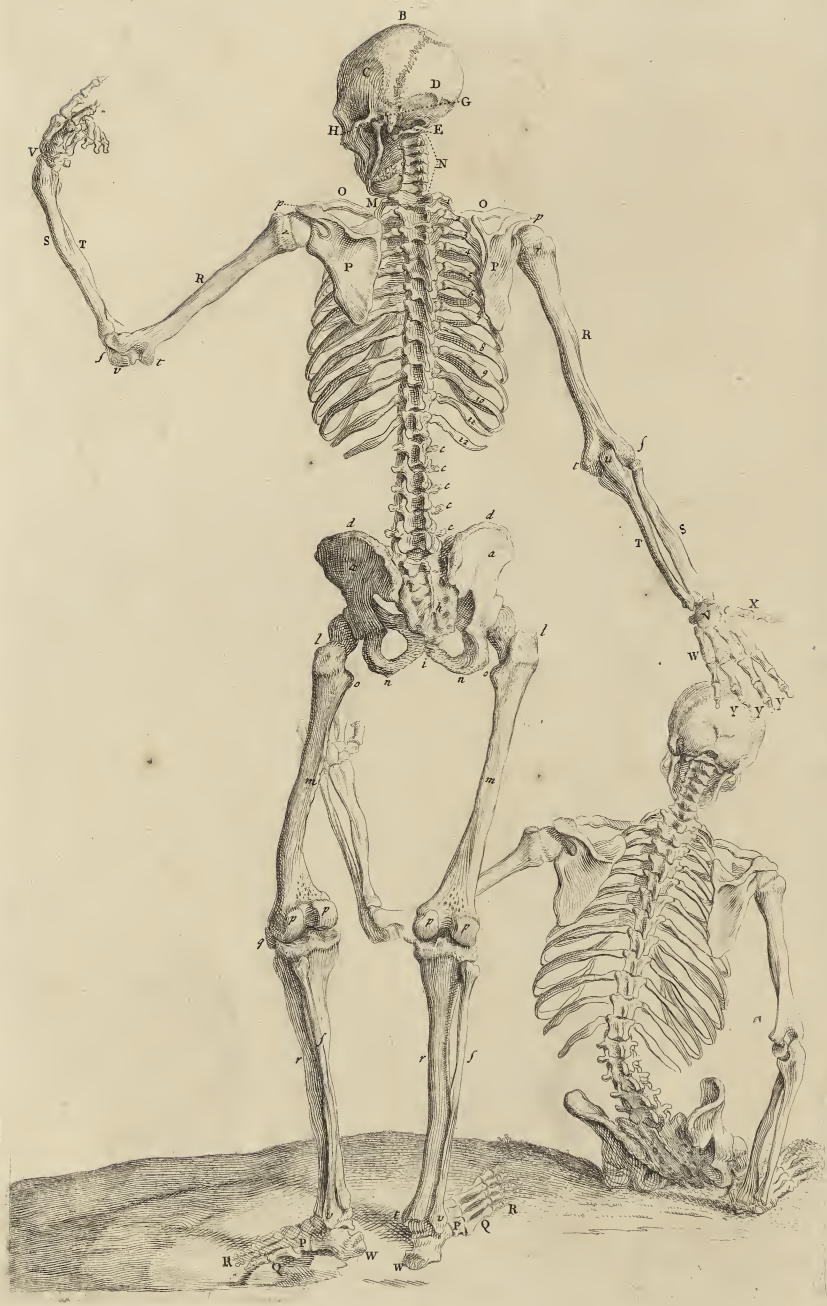
TAB. X.



TAB. X.

The back View of the Skeleton of a Man.

B *Offa Bregmatis.*
C *Os Temporale.*
D *Os Occipitis.*
E The Maftoide Procefs.
G The *Meatus Auditorius.*
H *Os Jugale.*
M The lower Jaw-bone.
N The feven *Vertebræ* of the Neck.
O The *Clavicula.*
P The *Scapula.*
p The *Acromium.*
R The *Humerus.*
r Its Head.
t The inner Protuberance.
ſ The outer.
S The *Radius.*
T The *Ulna.*
u The *Olecranon.*
V The Bones of the *Carpus.*
W of the *Metacarpus.*
X of the Thumb.
Y of the Fingers.
1, 2, 3, *&c.* The twelve Ribs.
c, c, c, c, c. The *Vertebræ* of the Loins.
h The *Os Sacrum.*
i The *Os Coccygis.*
a The Rife of the *Glutæus Minimus* from the *Os Ilium.*
d Its Spine.
n The obtufe Procefs of the *Ifchium.*
m The *Os Femoris.*
l The great *Trochanter.*
o The leffer.
p, p The two Heads of its lower *Appendix.*
q The *Patella.*
r The *Tibia.*
ſ The *Fibula.*
t The inner,
v The outer Ankle.
W The *Os Calcis.*
P The *Os Cuboides.*
Q The Bones of the *Metatarfus.*
R of the Toes.

TAB. XI. XII. XIII.

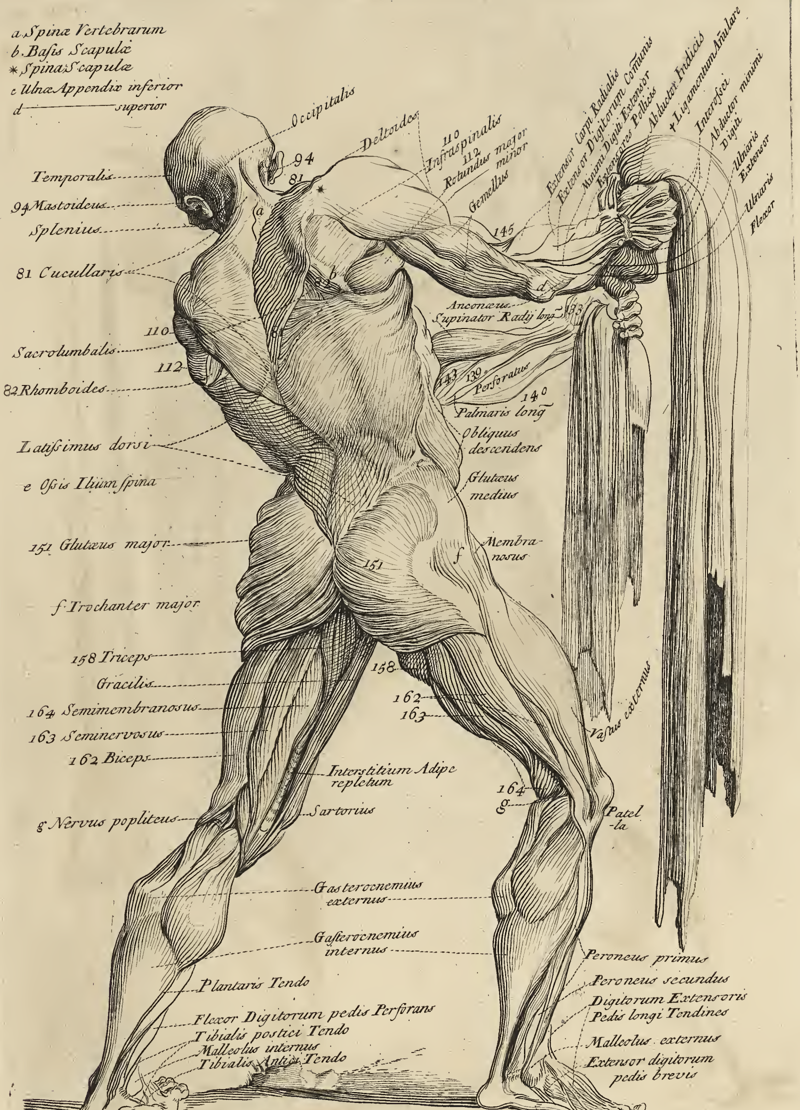
These Figures are chiefly design'd for the Use of Painters and Statuaries. The Outlines are copied from some of the greatest Masters, and the Muscles are laid in from the Life.

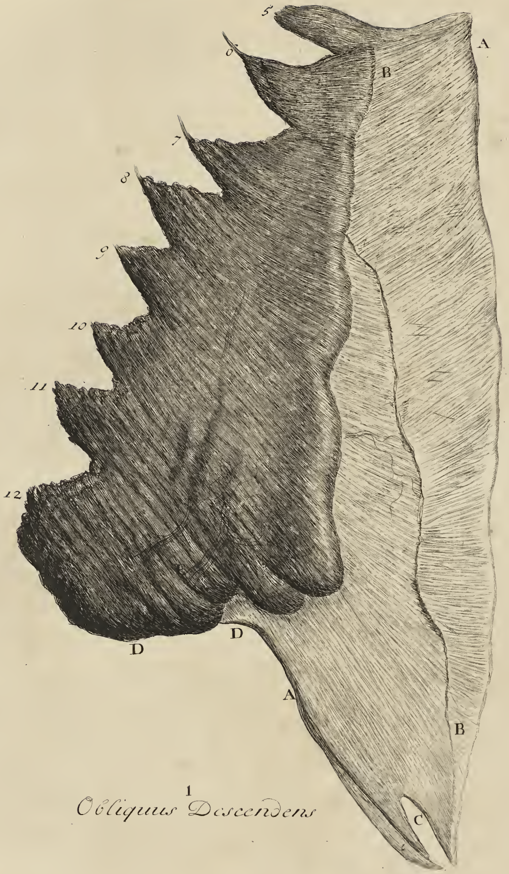
TAB.XI.


TAB. XII.

TAB. XIII.

TAB.XIII.


a Spinæ Vertebrarum
b Basis Scapulæ
* Spina Scapulæ
c Ulnæ Appendix inferior
d superior
Occipitalis
Temporalis
94 Mastoideus
Splenius
81 Cucullaris
110
Sacrolumbalis
112
82 Rhomboides
Latissimus dorsi
e Ossis Ilium spina
151 Glutæus major
f Trochanter major
158 Triceps
Gracilis
164 Semimembranosus
163 Seminervosus
162 Biceps
g Nervus popliteus
Deltoides
110 Infraspinalis
112 Rotundus major
minor
Gemellus
145
Anconæus
Supinator Radij long.
139
Perforatus
140
Palmaris long.
Obliquus descendens
Glutæus medius
Membranosus
151
158
162
163
Vastus externus
Interstitium Adipe repletum
Sartorius
164
Patella
Gasterocnemius externus
Gasterocnemius internus
Plantaris Tendo
Flexor Digitorum pedis Perforans
Tibialis postici Tendo
Malleolus internus
Tibialis Antici Tendo
Abductor pollicis
Peroneus primus
Peroneus secundus
Digitorum Extensoris Pedis longi Tendines
Malleolus externus
Extensor digitorum pedis brevis
Abductor minimi digiti
Extensor Carpi Radialis
Extensor Digitorum Communis
Minimi Digiti Extensor
Extensores Pollicis
Abductor Indicis
Ligamentum Anulare
Interossei
Abductor minimi Digiti
Ulnaris Extensor
Ulnaris Flexor



1
Obliquus Descendens

TAB. XIV.

1 *Shews the internal Surface of the* Muſculus Obliquus Deſcendens, *when diſſected and diſplay'd.*

5, 6, 7, 8, 9, 10, 11, 12. Its Originations cut from the fifth, ſixth, ſeventh, eighth, ninth, tenth, eleventh, and twelfth Rib: The ſuperiour three or four Digitations being taken from between the like Endings of the *Serratus Major Anticus.*

A A Its broad membranous Tendon, which terminated in the *Linea Alba,* Spine of the *Os Ilium,* and fore part of the *Os Pubis.*

B B Part of the Tendon of the *Aſcendens,* that cleaves inſeparably to that of the *Deſcendens.*

C A Fiſſure, commonly call'd a Perforation, in the Tendon of the *Deſcendens,* in which the Spermatick Veſſels paſs to the *Scrotum.*

c The lower Margin of the Tendon of the *Deſcendens,* call'd by ſome the *Ligamentum Pubis,* cut from the Spine of the *Os Ilium* and *Os Pubis,* turn'd in towards the Cavity of the *Abdomen,* as here expreſs'd. See Tab. XV. L L.

D D That part of this Muſcle, which is fix'd to the Spine of the *Os Ilium,* and is employ'd in turning the Trunk of the Body to the contrary Side.

B The Blood Veſſels of its lower Part.

TAB. XV.

2 *The* Muſculus Obliquus Aſcendens, *with the* Rectus *and part of the Tendon of the* Deſcendens, *together with the* Teſtis *of the Left Side diſſected and diſplay'd; to ſhew not only the Progreſs and Union of the Tendons of the two oblique Muſcles, over that of the* Rectus, *but the Artifice of Nature in tranſmitting the Spermatick Veſſels from the Cavity of the* Abdomen *to the* Teſtes, *whereby the conſtant falling down of the ſmall Guts into the* Inguina *and* Scrotum *is prevented.*

AB The tendinous part of the *Aſcendens*, that ſprings from the Spine of the *Os Ilium* backwards.

BB Its fleſhy Part, which ariſes from the anteriour Part of the Spine of the *Ilium*.

abc That part of the *Aſcendens* that is fix'd to the lower Margin of the inferiour Rib, and is employed in bringing the Trunk of the Body towards the back part of the *Os Ilium* of the ſame Side; in which Action it is aſſiſted by the *Obliquus Deſcendens* on the contrary Side, as before noted.

CD A part of the *Aſcendens*, that lies between the eleventh and twelfth Ribs.

DD The Tendon of the *Aſcendens* paſſing over the *Rectus*, where it was fairly ſeparated, as here expreſs'd, from that of the *Deſcendens*.

EE Part of the Tendon of the *Deſcendens* turn'd up, after the fleſhy part of that Muſcle was cut off, to ſhew where it adheres inſeparably to the ſubjacent Tendon of the *Aſcendens*, as they both march together over the *Rectus* GG, to the *Linea Alba*.

F Part of the *Tranſverſalis*.

H The Navel.

IKL A Portion of the Tendon of the *Obliquus Deſcendens*.

I That part of it which adher'd to the fore part of the Spine of the *Os Ilium*.

ddff Thoſe Parts of this Tendon which were here divided from each other.

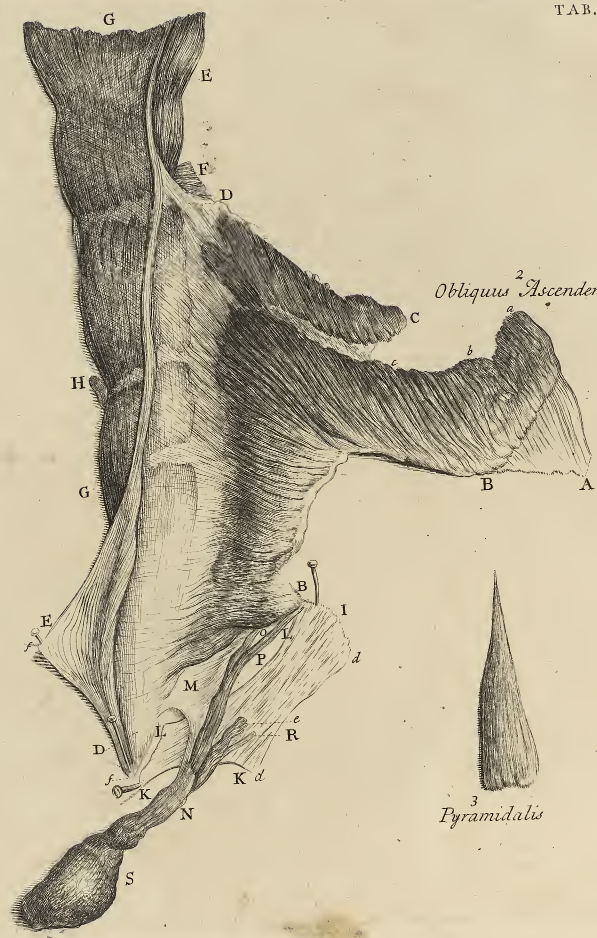
KK That part of it which makes the *Annulus*, or Fiſſure, by which the Spermatick Veſſels paſs to the *Teſtes*.

LL Its internal Margin, commonly call'd the Ligament of the *Pubes*, which, being as it were turn'd in towards the Cavity of the *Abdomen*, does by that means prevent any Ruptures or Extruſions of the Guts in that part, that is between the *Os Pubis* and Spine of the *Os Ilium*, and upper part of the Thigh.

MN Part of the *Peritonæum*, which deſcends with the Spermatick Veſſels into the *Scrotum*, and makes what is call'd the *Tunica Vaginalis*.

OP The *Muſculus Cremaſter*, which in this Subject was double at its Origine.

e The


G
E
F
D
Obliquus 2 Ascendens
C
a
b
c
H
G
B
A
B
I
L
P
d
E
M
L
D
e
R
K
K
d
N
S
3
Pyramidalis

e The *Vaſa Præparantia.*

R The *Vas Deferens* cut off.

S The Teſticle, as it appear'd in the *Tunica Vaginalis.* .

It appears by this Figure how the Spermatick Veſſels paſs between the two oblique Muſcles in their way to the *Teſtes*. For the Perforations in theſe two oblique Muſcles, not correſponding to each other, neceſſarily prevent the Inteſtines from paſſing the ſame way with the Spermatick Veſſels; which, had the Orifices in theſe Muſcles been oppoſite to each other, muſt have happened, as we ſee it does, when that Diſtemper, which we call a Rupture, attends theſe Parts; in which caſe it is very obvious, that the *Annulus*, or Perforation of the *Deſcendens*, here expreſs'd at K K, being enlarg'd or ſplit up according to the length of the Fibres of the Tendon, becomes oppoſite to that of the *Aſcendens* at O. Hence the ſmall Guts neceſſarily paſs into the *Scrotum* in an erect Poſture, unleſs prevented by a Compreſs, or Truſs, artificially made and applied to the Part; and we are aſſur'd from Experience, that, when this Remedy is us'd in young Perſons, or where the Malady is recent, it's often cur'd.

TAB. XVI.

4 *The internal Surface of the* Rectus Abdominis *of the Left Side.*

AB Tho' on the inſide there appear'd but one tendinous Interſection at A, and half an one at B, in this Subject, yet the external Surface of this Muſcle had three compleat tendinous Interſections. The Number and Situation of theſe Interſections vary in different Subjects, and in ſome this Muſcle has been found without any.

CD The Epigaſtrick, C, and Mammary Veins and Arteries, D, (as they are call'd) but are no more than the common Blood Veſſels of this Muſcle, and the ſubjacent Parts.

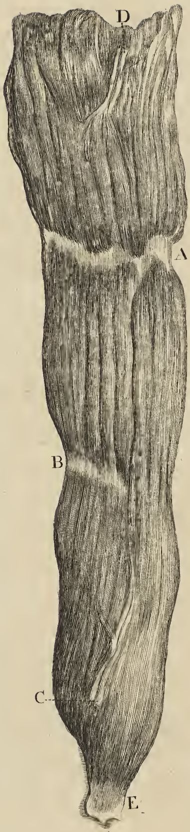
E The Tendon of the lower end of this Muſcle, which is implanted on the *Os Pubis*.

5 *The internal Surface of the* Tranſverſalis Abdominis *of the Left Side.*

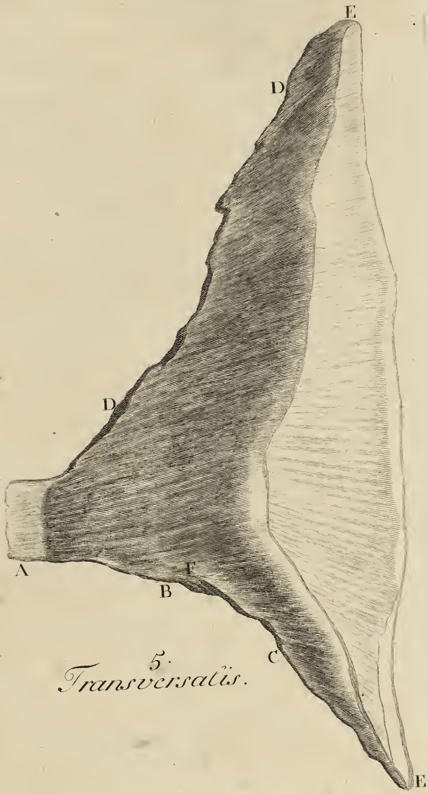
ABCDD Its tendinous Origine, that ſprings from the *Vertebræ* of the Loins, A. Its fleſhy Beginning from the Spine of the *Os Ilium*, B. That part of it which adher'd to the lower Margin of the Tendon of the *Deſcendens*, commonly call'd the *Ligamentum Pubis*, is expreſs'd at C, and that freed from the cartilaginous Endings of the Ribs at DD.

E E Its broad membranous Tendon, which adheres to the *Peritonæum*, as indeed does the whole Muſcle, except that part of it between ABD.

F Shews where the Spermatick Veſſels paſs it.



4.
Rectus.



5.
Transversalis.

6
Cremaster.

A *Accelerator Urinæ* .7
BB *Erectores Penis* . 8.
CC *Transversales Penis* . 9.

D *Sphinteris Ani portio*
EE *Arteriæ* } *Penis*
FF *Corpora Cavernosa* }
G *Corpus Cavernosum Urethræ*.

TAB. XVII.

6 The *Cremaſter* Muſcle, as I have found it expanded at its Termination on the *Tunica Vaginalis*, incloſing the *Teſtis* in a robuſt Subject.

A The *Corpus Varicoſum* of the *Vaſa Præparantia.*

B Part of the *Vas Deferens*, incloſed in the ſame Membrane with the *Vaſa Præparantia.*

C The Teſticle incloſed in the *Tunica Vaginalis.*

D The *Epididymis*, as it appears under the *Tunica Vaginalis.*

7 A The external Surface of the *Accelerator Urinæ* incloſing the Bulb of the *Corpus Cavernoſum Urethræ.*

a Its two Productions inſerted into the Sides of the *Corpora Cavernoſa Penis.*

8 BB The *Erectores Penis*, cut off from their fleſhy Originations at the *Iſchion*, and left at their Inſertions, at the beginning of the *Corpora Cavernoſa Penis*, bb.

9 CC The *Tranſverſales Penis*, as they appear'd in this Subject.

D Part of the *Sphincter Ani.*

EE The Arteries that convey Blood to the *Corpora Cavernoſa Penis*, FF, and to the *Corpus Cavernoſum Urethræ*, G.

TAB.

TAB. XVIII.

10. 10 The *Erectores Clitoridis* freed from their Originations, and left at their Insertions into the Beginnings of the cavernous Bodies of the *Clitoris.*

11 Part of the *Sphincter Vaginæ* freed from the *Vagina,* and left at its membranous Connexion to the *Clitoris.*

AA The *Crura* of the *Clitoris.*

a a Those parts of its cavernous Bodies that were cut from the *Ossa Pubis.*

B The Body of the *Clitoris,* with its Nerves and Blood Vessels.

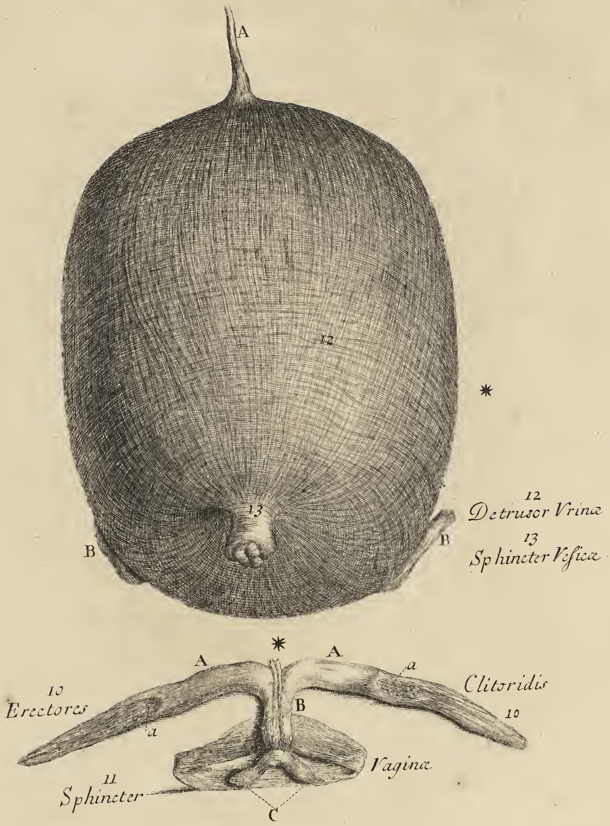
C Part of the *Nymphæ.*

12 The *Detrusor Urinæ,* as it appears in a Bladder I have now by me; but in other Subjects you must not expect to find these Fibres so conspicuous as here represented.

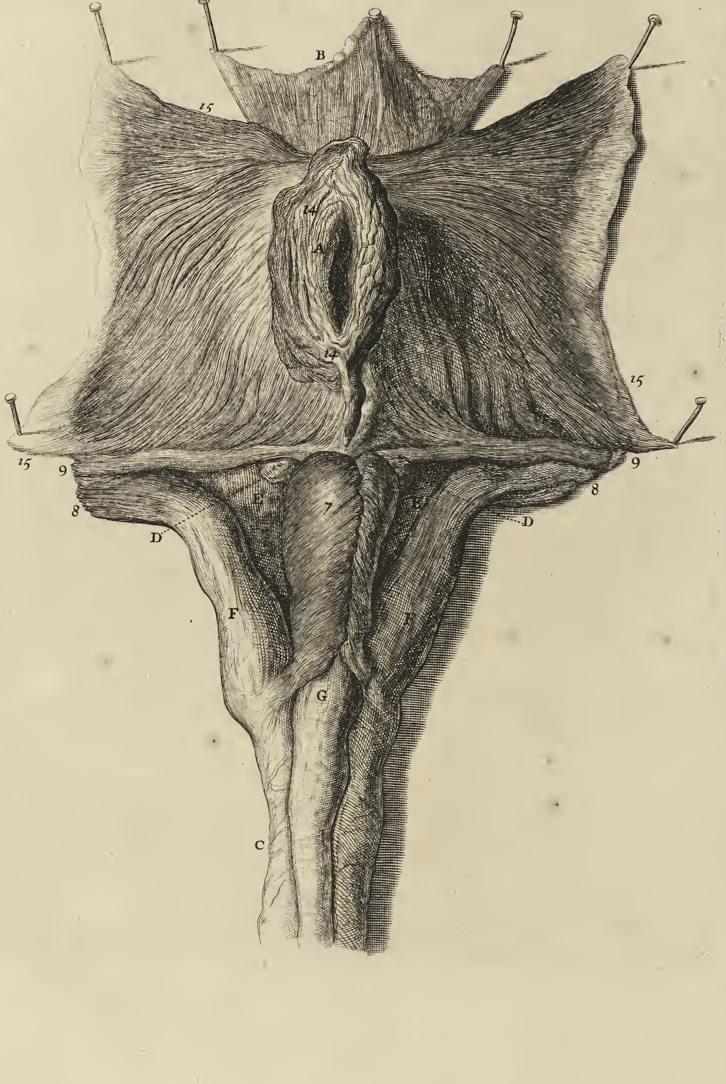
13 *Sphincter Vesicæ.*

A The *Urachus.*

BB Part of the Ureters, near their Insertions into the Bladder.


A
12
*
13
B
B
12
Detrusor Vrinæ
13
Sphincter Vesicæ
*
A
A
a
Clitoridis
10
Erectores
B
10
a
Vaginæ
11
Sphincter
C

TAB. XIX.



TAB. XIX.

A The *Anus*.
14 The *Sphincter Ani*.
B Part of the *Rectum* pinn'd out.
15 The *Levator Ani* freed from its Origination, and left at its Insertion, pinn'd out.
C The *Corpora Cavernosa Penis*.
DD The *Glandulæ Mucosæ*.
7 EE *Acceleratores Urinæ*.
88 The Origination of the *Erectores* cut from the *Ossa Ischia*.
FF Their Insertion.
G *Corpus Cavernosum Urethræ*.
99 *Transversales Penis*.

TAB. XX.

AA The *Sphincter Ani* encompaſſing the *Anus.*

aa The internal Membrane of the *Anus.*

BB The *Levator Ani* freed from its Origination, and left at its Inſertion, here pinn'd out.

CC The *Membrana Adipoſa,* (which is continued from the *Peritonæum*) freed from the *Rectum,* and diſplay'd.

D The Body of the *Rectum,* with Muſcular Fibres paſſing according to its Length.

EE The circular Fibres, lying under the Longitudinal, which are here rais'd and turn'd off.

F The internal Membrane of the *Rectum* pinn'd out. This internal Membrane, being much larger than the Muſcular Incloſure, is ſeen full of Folds, on dividing the Gut according to its Length; ſometimes 'tis ſo much relax'd, as to ſlip out at the *Anus,* which Caſe is called *Procidentia Ani.*

16 The *Occipitalis.*

17 The internal Surface of the *Frontalis,* of the Left Side.

A The two tendinous Parts, which are continued to each other, on the upper part of the *Cranium.*

a That part of the Frontal Muſcle which ariſes from the lower part of the Bone of the Noſe.

b That part of the Frontal Muſcle call'd *Corrugator.*

cc A Branch of an Artery that paſſes a Perforation in the Scull, a little above the Orbit, and diſtributes its Capillary Branches, as here expreſs'd, on the internal Surface of this Muſcle.

d Two Branches of the Nerve, which accompanies the Artery.

27 Part of the *Muſculus Orbicularis Palpebrarum.*


A
16.
Occipitalis.
A
17
b
d
c
27
a
17.
Frontalis.
F
E
E
C
D
C
B
A
a
a
A
B
B
A Sphincter. 14.
B. Levator. 15.
Ani.

TAB. XXI.

18. Quadratus Genæ, seu Quad. Colli.
19. Buccinator Quadrato Genæ tectus.
20. Zygomaticus.
21. Elevator Labiorum.
22. Depressor Labiorum.
23. Orbicularis Labiorum.
24. Elevator labii superioris proprius.
25. Depressor labii inferioris proprius.

TAB. XXI.

Since cutting off the Muſcles of the Face, and then diſplaying them, (as I have done thoſe of moſt other Parts) would produce a Figure of them by no means inſtructive; I ſhall therefore repreſent them in the two following Tables in ſitu, *in which theſe Muſcles are expreſs'd much larger than thoſe in the whole Figures.*

18 18 The *Quadratus Genæ,* as much as can be ſeen in one View.
19 That part of it that is over the *Buccinator.*
20 The *Zygomaticus,* the lower part of which lies under part of the *Quadratus.*
21 Another part of the *Quadratus,* on the *Elevator Labiorum.*
22 The *Depreſſor Labiorum.*
23 The *Orbicularis Labiorum.*
24 The *Elevator Labii Superioris.*
25 The *Depreſſor Labii Inferioris.*
A The *Muſculus Frontalis.*
B The *Orbicularis Palpebrarum.*
C The *Temporalis.*
D The *Elevator Auriculæ.*
E The *Occipitalis.*
F The *Os Jugale.*
G, *g* The *Elevator Alæ Naſi.*
H The Parotide Gland.
I The *Ductus Salivalis* under the *Quadratus.*
K Part of the *Splenius.*
L The *Deltoides.*
M Part of the *Gemellus.*
N Part of the *Brachiæus Internus.*
O *Biceps Cubiti.*
P Part of the *Serratus Major Anticus.*
Q Part of the *Obliquus Deſcendens.*
k The Extremity of the *Clavicula,* next
l The *Acromium Scapulæ.*

The reſt of the Parts that appear under the *Quadratus* on the Neck and Breaſt, may be known by the following Figure.

TAB.

TAB. XXII.

19 The *Buccinator.*

20 The *Zygomaticus.*

21 The *Elevator Labiorum.*

22 The *Depreſſor Labiorum.*

23 The *Orbicularis Labiorum.*

24. 24 The *Elevator Labii Superioris Proprius.*

25 The *Depreſſor Labii Inferioris Proprius.*

A Part of the *Os Jugale.*

B The Temporal Artery.

CC The Parotide Salival Gland.

D Its *Ductus Salivalis* paſſing on the *Muſculus Maſſeter,* and through the *Buccinator,* into the Mouth.

E Part of the lower Jaw-Bone bared.

o, o, o, o, o, A Branch of the Carotide Artery, which conſtantly paſſes this way to the Muſcles of the Lips and Parts adjacent.

N A Branch of the external Jugular Vein.

f An Appearance of the ſame Vein, before it paſſes the Body of the inferiour Maxillary Gland.

g The Maxillary Salival Gland.

G The *Clavicula* bared.

H The *Acromium Scapulæ,* where it is joyn'd to the *Clavicula.*

h A Trunk of the Nerves, that compoſe the Axillary Nerve.

I The *Os Pectoris,* or *Sternum.*

i Some Remains of the external Jugular Vein on the Maſtoide Muſcle.

* 72 Part of the *Serratus Major Anticus,* which appears, as here expreſs'd, above the *Clavicula,* in an Interſtice made by the *Scalenus* forwards, the *Levator Scapulæ* above, and the *Cucullaris.*

N. B. The reſt of the Figures, or Numbers, may be explain'd by the general Index of the Muſcles.

TAB. XXII.

19. *Buccinator.*
20. *Zygomaticus.*
21. *Elevator Labiorum.*
22. *Depressor Labiorum.*
23. *Orbicularis Labiorum.*
24.24. *Elevator Labij Superioris proprius.*
25. *Depressor Labij inferioris proprius.*

TAB. XXIII.

A Os Jugale
BBB Maxilla Inferior denudata
C Processus Mastoeides
D Processus Styloeides
E Musculus Parvus, qui in nonnullis Cadaveribus Ligamentum tantūmodo est, ab Apice Processus Styloeidis ad Maxillam Inferiorem pertingens
F Arteriæ Ramulus Cera repletus
G Ductus Salivalis Glandulæ Maxillaris Inferioris Abscissus quo loci sub Musculo Mylohyoideo transit.

✠ Ramulus Quinti Nervorum Paris ad Dentes Maxillæ Inferioris pertinens
H. Musculi Styloglossi pars
II Vena Jugularis interna } utraq; Cera plena
KK. Arteria carotis }
LL Processus Transversi Vertebrarū Colli
ll Nervi Intercostalis et Paris Vagi Trunci
M Os Hyoides
N Cartilago Scutiformis
O Glandula Thyroides

TAB. XXIII.

The Parts here repreſented, being ſufficiently deſcribed in the References at the bottom of the Plate, need no other Explication, except

101 101 The lowermoſt of which denotes one of the *Intertranſverſales*, which were, diſcover'd by the Author, after his *Syllabus* and moſt of the Plates were finished, for which reaſon thoſe Muſcles could not be inſerted under a diſtinct Number. *Vid.* Tab. XLIV. The uppermoſt ſhews te ticker and ſhorter Production of the *Tranſverſalis*, which is inſerted near the Maſtoide Proceſs. But the ſlenderer and longer Production of this Muſcle is inſerted beſide.

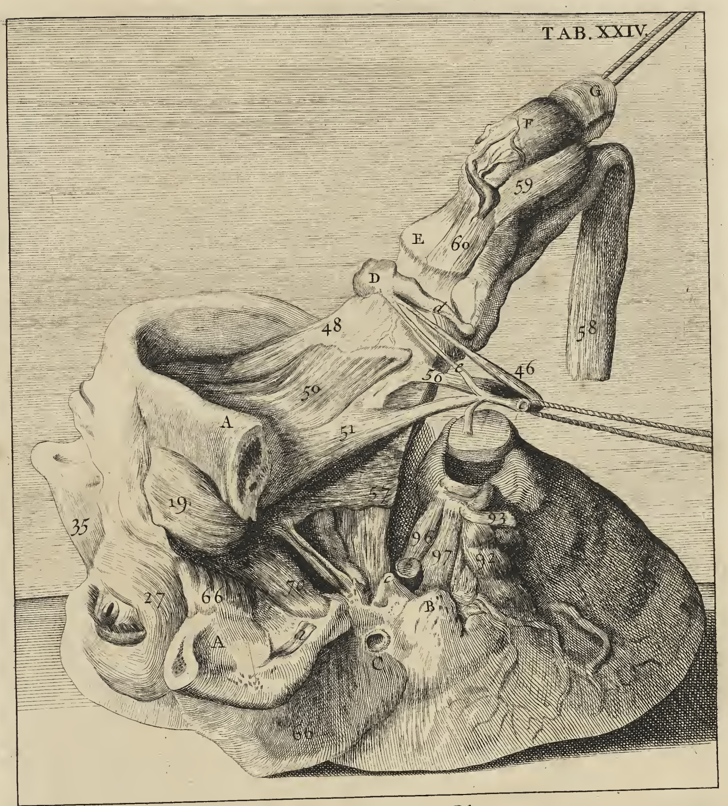
102 Part of the *Longiſſimus Dorſi*, by others call'd *Par tertium Falloppii.* *Vid.* Tab. XLV.

TAB. XXIV.

This Table likewise needs no other Explication, than what is engraven on the bottom of the Plate, except

a The Nerve and Blood Vessels passing intho the lower Jaw.

e The Ligament connecting the cartilaginous *Appendix* of the *Os Hyoides* to the Styloidal Process.



AA. *Maxilla inferior divisa.*
B. *Processus Mammillaris.*
b. *Arteria Carotis.*
C. *Meatus Auditorius.*
cc. *Processus Styloides divisus.*
D. *Os Hyoides.*
d. *Cornu dextrum ejusdem.*
E. *Cartilago Thyroides.*
F. *Glandula Thyroides.*
G. *Asperæ Arteriæ portio.*

TAB.XXV.

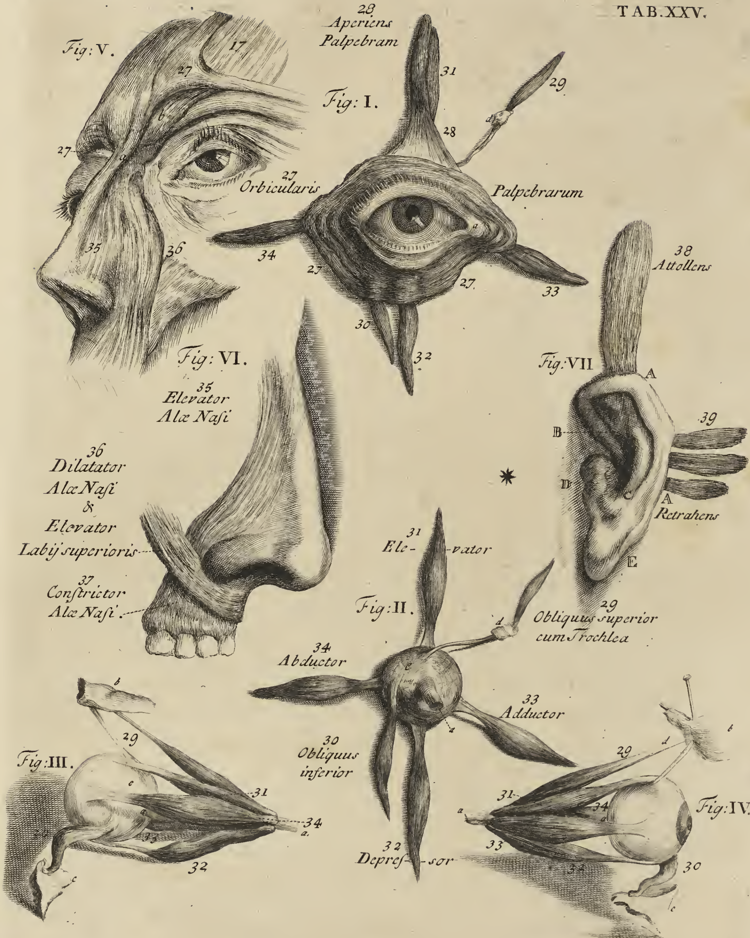


Fig: V.
17
27
27
35
36
28
Aperiens
Palpebram
Fig: I.
31
29
28
27
Orbicularis
Palpebrarum
34
27
27
33
30
32
38
Attollens
Fig: VI.
35
Elevator
Alæ Nasi
Fig: VII
A
B
D
39
A
Retrahens
E
36
Dilatator
Alæ Nasi
&
Elevator
Labij superioris
37
Constrictor
Alæ Nasi
31
Ele- vator
Fig: II.
29
Obliquus superior
cum Trochlea
34
Abductor
33
Adductor
30
Obliquus
inferior
32
Depres- sor
Fig: III.
29
31
34
32
29
31
34
33
Fig: IV.
30

TAB. XXV.

The Muſcles of the Eye-lid and Eye, the Ala Naſi & Auricula, *as big as the Life.*

FIG. I.

The Muſcles of the Palpebra, *and right Eye it ſelf, diſſected and diſplay'd.*

a The inner *Canthus.*
27 27 The *Orbicularis Palpebræ.*
28 The *Aperiens Palpebram Rectus.*
29 The *Obliquus Superior*, with
d Its *Trochlea.*
30 The *Obliquus Inferior.*
31 The *Elevator.*
32 The *Depreſſor.*
33 The *Adductor.*
34 The *Abductor Oculi.*

FIG. II.

The back part of the Muſcles of the Left Eye diſſected and diſplay'd.

N. B. The Names of each Muſcle being graved on the Copper-Plate, I ſhall only add here,
d The *Trochlea.*
a Part of the Optick Nerve cut off.
e The Terminations of the two Tendons of the oblique Muſcles on the *Sclerotis.*

FIG. III. IV.

The Muſcles of the Eye diſſected, and ſo diſpos'd, as to ſhew the natural Poſition of each Muſcle in the Left Eye.

N. B. The Muſcles are explain'd by the perceding Figure, or the general *Index.*

a a The Optick Nerve.

b A Portion of the external Margin of the upper part of the Bone of the Orbit, to which the *Trochlea* is fix'd.

c Part of the external Margin of the lower part of the Bone of the Orbit, whence the *Obliquus Inferior* ariſes.

d The Tendon of the *Obliquus Superior* paſſing through the *Trochlea*, the other part of its Tendon is here expreſs'd, marching under thath of the *Elevator* to its Termination on the *Sclerotis*, near the Inſertion of the *Obliquus Inferior*, as expreſs'd in Fig. II. and III. at *e*.

FIG. V. VI.

35 The *Elevator Alæ Nasi.*

36 The *Dilatator Alæ Nasi & Elevator Labii Superioris.*

37 The *Constrictor Alæ Nasi.*

N. B. In Fig. v. is expreſs'd.

17 Part of the *Frontalis.*

27 The *Orbicularis*, part of that of the Left Side at the great Angle being raiſed, to ſhew.

b The internal and fleſhy Production of the *Muſculus Frontalis.*

a The external Production of the Frontal Muſcle, ſpringing from the Bones of the Noſe, which is very viſible in ſome Perſons when in Paſſion.

FIG. VII.

The Left Ear, with its Muſcles, as I have moſt commonly found them, they varying in their Figure in different Subjects.

38 *Attolens Auriculam.*

39 *Retrahens Auriculam.*

A A That part of the Ear called *Helix.*

B *Anthelix.*

C *Tragus.*

D *Antitragus.*

E *Lobus Auris.*

TAB.

Tab: XXVI.

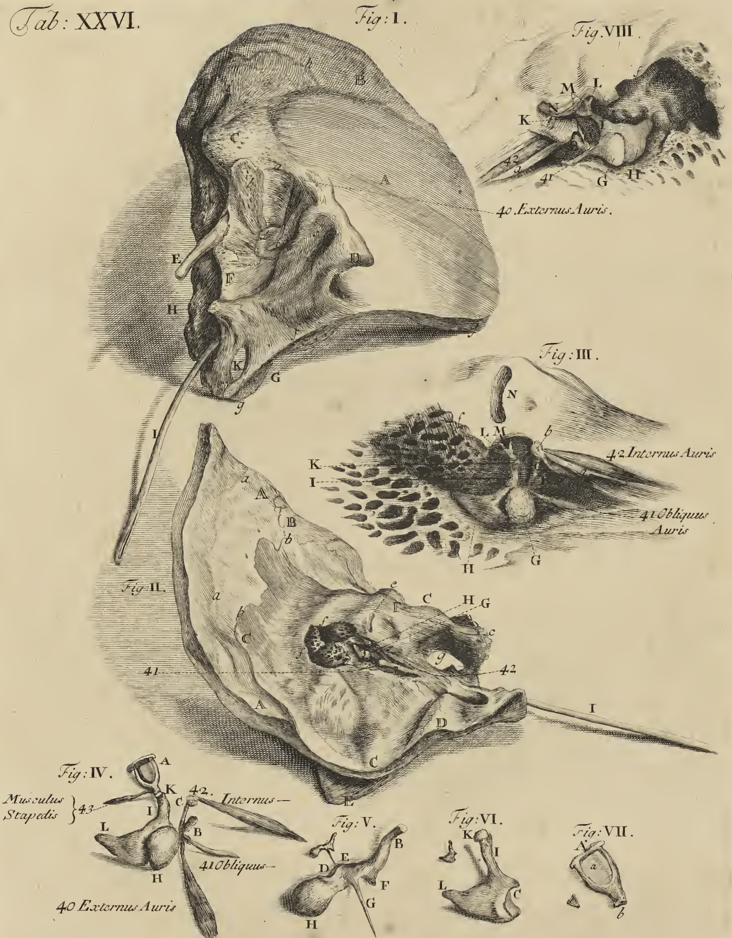


Fig: I.
Fig. VIII
40 Externus Auris.
Fig: III.
42 Internus Auris
41 Obliquus Auris
Fig. II.
Fig: IV.
Musculus Stapedis
43
42. Internus
41 Obliquus
40 Externus Auris
Fig: V.
Fig: VI.
Fig: VII.

TAB. XXVI.

FIG. I.

Part of the Right Os Temporale, *&c. containingh the Organs of Hearing of the Right Side as big as the Life.*

A The external convex Surface.
B Part of the *Os Sincipitis.*
C The *Processus Mastoides.*
D Part of the *Os Jugale* cut off.
E The *Processus Styloides.*
F Part of the *Os Temporum*, behind which the Carotide Artery passes to the Brain.
G Part of the *Os Sphenoides.*
H An acute Process of the last mention'd Bone, at the Root of which the Muscles of the *Uvula* spring.
I A Probe inserted inter a Perforation, between the *Os Sphenoides* and *Os Temporum*, by which the *Ductus à Palato* passes into the *Tympanum*, as express'd Fig. II.
K The sixth *Foramen* of the *Os Sphenoides*, near the Root of the *Processus Pterygoides*, by which the fifth pair of Nerves pass.
a The upper part of the Passage from the outward Ear to the *Membrana Tympani.*
b The breaking off of the Bone, which makes the lower part of the Passage.
40 The *Musculus Externus Auris.* Vid. Fig. IV.
c The Process of the *Malleus*, on the *Membrana Tympani.*
d The *Membrana Tympani*, commonly call'd the Drum of the Ear.
e The *Sinus* of the *Os Temporum*, for the Articulation of the *Processus Condyloides* of the lower Jaw.
f The Suture or Conjuction of the *Os Sphenoides* with the *Os Temporum.*
gg The Edges of the last named Bones saw'd off.
h The Suture between the *Os Temporale* and *Sincipitis.*
i A *Sulcus* in the *Os Temporum*, whence the Digastrick Muscle of the lower Jaw springs.

FIG. II.

The internal Surface of the same Bones, with the Organs of Hearing, represented in the preceding Figure.

A A The inside of the lower part of the *Os Sincipitis*, next the Brain.
a a The Furrows caused by the Blood Vessels of the *Dura Mater.*
B Part of the *Os Occipitis.*
b b The *Sutura Squamosa* of the *Os Temporum* with the *Sinciput* and *Occiput.*
CCC The Surface of the *Os Temporum* next the Brain.

D Part of the *Os Sphenoides.*

E Part of the *Os Jugale.*

F The *Os Petrosum.*

I The Probe in the *Ductus a Palato ad Aurem.*

c The Edge of the *Os Sphenoides.*

e The external ſemicircular Canal laid open.

f The internal ſpongious part of the Bone.

g The *Foramen* expreſs'd at K in the preceding Figure.

The remaining Parts of this Figure are explain'd in the References to Fig. III.

FIG. III.

Part of the preceding Figure at f, G, H, 41, 42, *magnify'd.*

a The *Ligamentum Vaginale* of the *Muſculus Internus Auris*, ſlit open and turn'd down, to ſhew the incloſed Muſcle.

42 The *Internus Auris.*

b The Proceſs of the *Os Petroſum*, on which the Tendon of the laſt named Muſcle paſſes.

C The Tendon of the ſaid Muſcle deſcending to its Inſertion on the *Malleus.*

B Part of the Handle of the *Malleus.*

G The Head of the *Malleus.*

H The *Incus.*

I Its long Proceſs, which is articulated with the *Stapes*, by the Mediation of

K The *Os Orbiculare.*

M Part of the *Stapes*, as it appears *in ſitu.*

L The Tendon of the *Muſculus Stapedis.*

N The external ſemicircular Duct opened.

FIG. IV.

The four little Bones of the right Ear taken out with their Muſcles.

A The *Stapes.*

B Part of the Handle of the *Malleus.*

C The Tendon of the *Muſculus Internus.*

H The Head of the *Malleus.*

The long Proceſs of the *Incus.*

K The *Os Orbiculare.*

L The ſhort thick Proceſs of the *Incus.*

FIG. V. VI. VII.

Tho Malleus, Incns, *and* Stapes, *as big as the Life, and magnify'd.*

A The *Basis Stapedis.*
a The Membrane in the hollow of the *Stapes.*
b The *Sinus* on the Head of the *Stapes*, which receives the *Os Orbiculare.*
C The *Sinus* of the *Incus*, which receives the *Malleus.*
D The part of the *Malleus*, which is receiv'd by the *Incus.*
B The Handle of the *Malleus.*
E That part of the *Malleus*, where the Tendon of the *Musculus Internus* is inserted.
F A Process of the *Malleus*, where it begins to adhere to the *Membrana Tympani.*
G A slender long Process of the *Malleus*, to which the Tendon of the *Musculus Obliquus* is fastened.
H The Head of the *Malleus.*
I The long Process of the *Incus*, at the Extremity of which is.
K The *Os Orbiculare*, which is receiv'd in the Cavity of the *Stapes*, at *b.*

FIG. VIII.

The same Organs of the Left Ear magnify'd in the same Position, as in Fig. III. *the Letters of Reference to both being the same, except that*

N Shews a Branch of the Auditory Nerve, in this Figure.

TAB. XXVII.

FIG. I.

The upper Surface of the Os Hyoides, *when freed from its Muscles.*

A The fore Bone, called the *Basis* of the *Os Hyoides.*

BB The two Extremities called *Cornua*, one of which in this Subject happen'd to be bent, as appears in the Figure.

CC Two cartilaginous Appendices, from which.

DD Two Ligaments are continued to the Extremities of the Styloidal Processes.

E Part of the Styloidal Process of the Right Side.

FIG. II.

The internal Surface of the same Os Hyoides.

FIG. III. IV.

The internal and external Surface of the Os Hyoides *from another Body.*

The two other Figures represent the Os Hyoides *taken out with its Muscles.*

A The fore Bone, or *Basis* of the *Os Hyoides.*

B Its right *Cornu.*

44. 44 *Par Sternohyoideum.*

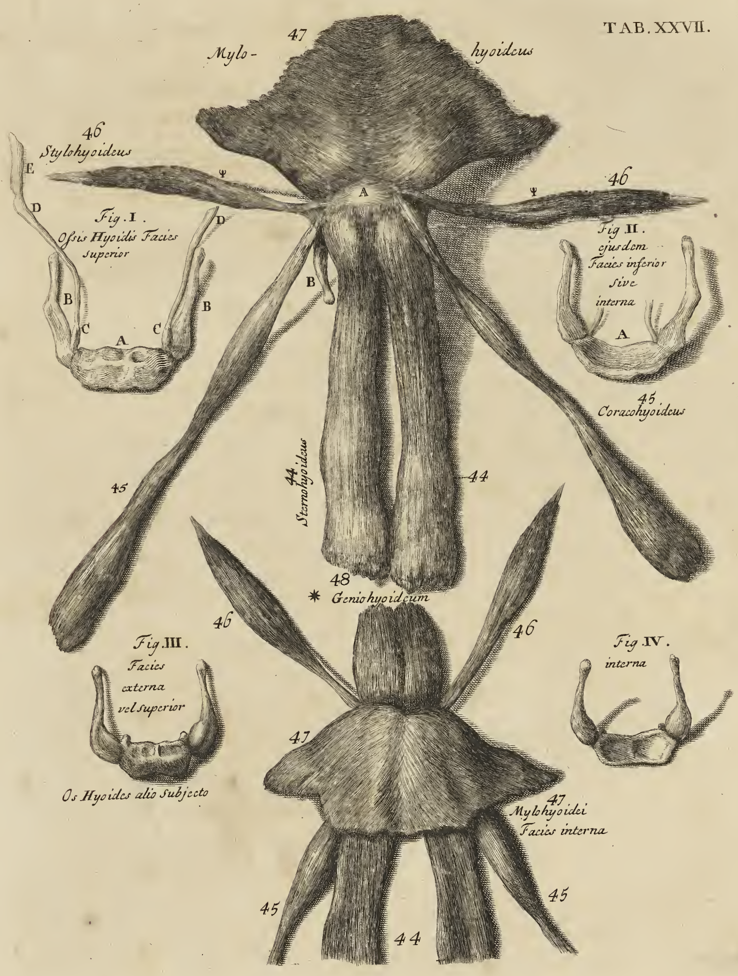
45. 45. *Par Coracohyoideum.*

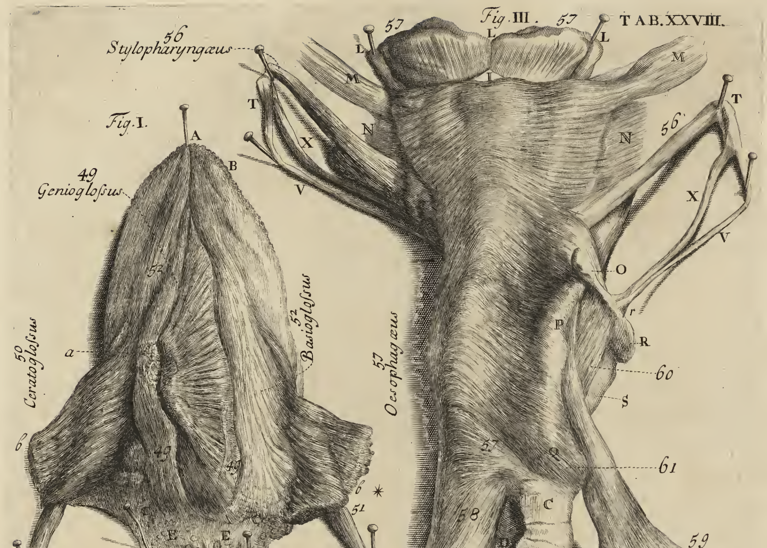
47. 47 The upper Figure shews the external Surface of the *Mylohyoideus*, the lower the internal Surface.

46 The *Stylohyoideus.*

Ψ Its Perforation, by which passes the middle Tendon of the *Musculus Digastricus* of the lower the Jaw.

48 *Par Geniohyoideum.*


47
Mylo- hyoideus
46
Stylohyoideus
E
D
Fig. I.
Ossis Hyoidis Facies superior
D
B
B
C
A
C
A
B
46
Fig. II.
ejusdem Facies inferior sive interna
A
45
Coracohyoideus
44
Sternohyoideus
44
45
48
* Geniohyoideum
46
46
Fig. III.
Facies externa vel superior
Os Hyoides alio Subjecto
Fig. IV.
interna
47
47
Mylohyoidei Facies interna
45
45
44


TAB. XXVIII.
Fig. I.
Fig. II
Fig. III.
Fig. IV.
56 Stylopharyngæus
49 Genioglossus
50 Ceratoglossus
52 Basioglossus
51 Styloglossus
55 Pterygostaphilinus
54 Sphenostaphilinus
57 Oesophagæus
58
59
60
61

TAB. XXVIII.

FIG. I.

The Tongue, with its Muſcles cut from their Originations, and left at their Inſertions into the Body of the Tongue.

49 The *Genioglossus.*

a The Origination of it, cut from the internal part of the Jaw-bone.

50 The *Ceratoglossus.* *bb* The Originations of theſe Muſcles cut from the *Cornua* of the *Os Hyoides.*

51 The *Styloglossus.*

52 The *Basioglossus.*

A The Tip of the Tongue pinn'd out.

B Part of its *Corpus Villoſum*, as it appear'd on its Sides in this Poſition.

CC The *Baſis*, or Root of the Tongue.

D The Membrane, that is continued from the Tongue on the *Epiglottis*, with its Salival Miliary Glands E, as they appear'd on its internal Surface. Theſe Glands are very conſpicuous in Oxen: You may ſee them on the *Epiglottis* of a dry'd Neat's Tongue, as its call'd, on which, I muſt confeſs, I firſt obſerv'd them, and afterwards diſcover'd them in human Bodies. When the Exeretory Ducts of theſe (E) and the neighbouring Glands are obſtructed, the Patient is oblig'd to ſwallow the Spittle very often to moiſten theſe Parts; an Inſtance of which I found in a Gentleman, that is now my Patient, who has a hard Tumour on the upper part of the Scutiformal Cartilage of the *Larynx.*

FIG. II.

The back part of the Muſcles of the Uvula, *with the upper part of thoſe of the* Fauces, *when diſſected.*

FF The Extremities of the *Proceſſus Pterygoidei* broken off, to ſhew the Progreſs of the Tendons of the *Muſculi Pterygoſtaphylini* (55) over them on eaeh Side.

G The cartilaginous beginning of the Tube between the *Fauces* and the Ear, cut out, to ſhew its Connexion to the laſt mention'd Muſcle, 55.

H The hind part of the *Uvula.*

I The back part of the *Fauces* pinn'd up.

53 Part of the *Muſculi Gloſſoſtaphylini.*

54 The *Sphenoſtaphylini.*

55 The *Pterygoſtaphylini.*

K Their Tendons ſeparated from the *Os Palati.*

LL The Fibres of that part of the *Muſculus Oeſophagæus*, which ſprings from the laſt mention'd Tendons on each Side, and the Extremities of the *Proceſſus Pterygoidei.* This I formerly call'd *Pterygopharyngæus*; but finding it ſo compli-

cated

cated with the *Oesophagæus*, I choose to represent it under that Title, being willing to retrench, as much as possible, the number of the Muscles, especially such as are not fairly to be separated from each other.

MM Another part of the *Musculus Oesophagæus*, which springs from the lower Jaw-bone.

NN A third Series of Fibres of the *Oesophagæus*, springing from the *Uvula*, and ending in the Sides of the *Fauces* and Scutiformal Cartilage. *Vid.* Tab. XXIX. Fig. I. and II. N. N.

OO A fourth part of the *Oesophagæus*, that arises from a Cartilaginous Appendix of the *Os Hyoides*. *Vid.* Fig. III. O, and Tab. XXIX. Fig. II.

PP Another part of the *Oesophagæus*, that comes from the Sides of the Scutiformal Cartilage, express'd at P, Fig. III.

FIG. III.

The back part of the Muscles of the Fauces, *connected to the* Os Hyoides *and* Larynx.

C The Cartilaginous Rings of the *Larynx*.

D Its back part, which is membranous, to give way for the Dilatation of the *Oesophagus* in swallowing.

LLL That part of the *Oesophagæus*, that springs from the *Processus Pterygoidei*, the Tendons of the *Musculi Pterygostaphylini*, and the *Os Occipitis*, and has a different Order of Fibres from its external ones express'd at I, which are connected to the middle of the anteriour *Appendix* of the *Os Occipitis*.

MM Those parts of the *Oesophagæus*, that arise from the lower Jaw.

NN Its Fibres, that spring from the Root of the Tongue.

O From the *Os Hyoides*.

P From the Scutiformal Cartilage.

Q From the *Cartilago Cricoides*.

R The *Os Hyoides*. *r*. Its Cartilaginous Appendix.

S The *Cartilago Thyroides*.

T The *Processus Styloides*.

VV Two Ligaments fastened to the Extremities of the *Processus Styloides* and Cartilaginous Appendices of the *Os Hyoides* on each Side.

XX A pair of Muscles, most commonly found springing fleshy from the *Processus Styloides*, and terminating in the Cartilaginous *Appendices* of the *Os Hyoides*, r.

56 The *Stylopharyngæi*, with their Originations from the *Processus Styloides* and their Insertions into the *Pharynx*.

57. 57. The back part of the *Oesophagæus*.

58. 58. The external Surface of the *Vaginalis Gulæ*, as it appears, when distended with Wind.

59 The

59 The *Sternothyroideus* left at its Implantation into the *Cartilago Thyroides.*

60 The *Hyothyroideus in Situ.*

61 The *Cricothyroideus in Situ.*

FIG. IV.

The Muscles of the Uvula, *clear'd and left in their natural Situation.*

a The *Uvula* pinn'd up.

bb The *Processus Pterygoideus* bar'd.

c A Ligament, which is continu'd from the Extremity of an acute Process of the *Os Sphenoides,* d, to the *Processus Pterygoideus.*

e The *Septum Narium.*

ff The Cartilaginous Extremities of the Tube, between the Palate and Cavity of the *Tympanum.*

g Part of the *Musculus Pterygoideus Internus* of the lower Jaw.

54 The *Sphenostaphylinus.*

55 The *Pterygostaphylinus.*

TAB. XXIX.

FIG. I. II.

The fore Parts of the Muſcles of the Uvula *and* Fauces *diſſected and cleared of their Glandulous Membranes.*

F G H The fore Parts of the ſame Organs explain'd in the preceding Table at F. G. H. Fig. II.

H Fig. II. The back part of the *Uvula*, here ſeen by its being pinn'd up.

I I The internal Series of fleſhy Fibres of the *Oeſophagæus* Muſcle, that ariſe from the *Appendix* of the *Os Occipitis*, and decuſſate the external Fibres, expreſs'd Fig. II. and III. of the foregoing Table, at I, I, 57, 57. Theſe Fibres are join'd with others ſpringing from the Tendons (K) of the *Pterygoſtaphylini*, at L L, from the lower Jaw, at M M, and *Uvula*, at N N.

53 The *Gloſſoſtaphylinus*, with part of the Tongue remaining.

54 The *Sphenoſtaphylinus*.

55 The *Pterygoſtaphylinus*.

56 The *Stylopharyngæus*.

57: 57 The *Oeſophagæus*. Thoſe Parts of it which decuſſate the Fibres at I, L, M, and N, ariſe at O from the Cartilaginous *Appendices* of the *Os Hyoides*, and its Extremities; at P P, from the *Cartilago Thyroides*; at Q, from the *Cricoides*.

58 Part of the *Vaginalis Gulæ*.

R The internal Membrane of the *Gula*, which makes the *Glottis*, ſupported on a Pin.

S S The *Amygdalæ*, or *Tonſillæ*.

T Some ſmall Glands left, on taking off the internal Membrane, to ſhew the Series of Fibres underneath.

V V The Glandulous Body of the Palate, cut from the *Os Palati*.

FIG. III.

The Gula *diſtended with Wind, to ſhew*

58 The *Vaginalis Gulæ*.

A Its external Surface, compos'd of Fibres paſſing ſomewhat obliquely, according to its Length.

B B Its internal circular Fibres.

C C The external and internal Fibres raiſed, to ſhew their Decuſſation.

FIG. IV.

The Muſculus Vaginalis Gulæ, *ending on the Left Orifice of the Stomach.*

A A Its external Fibres.

B Its internal Fibres ſtill croſſing the former on the Stomach.

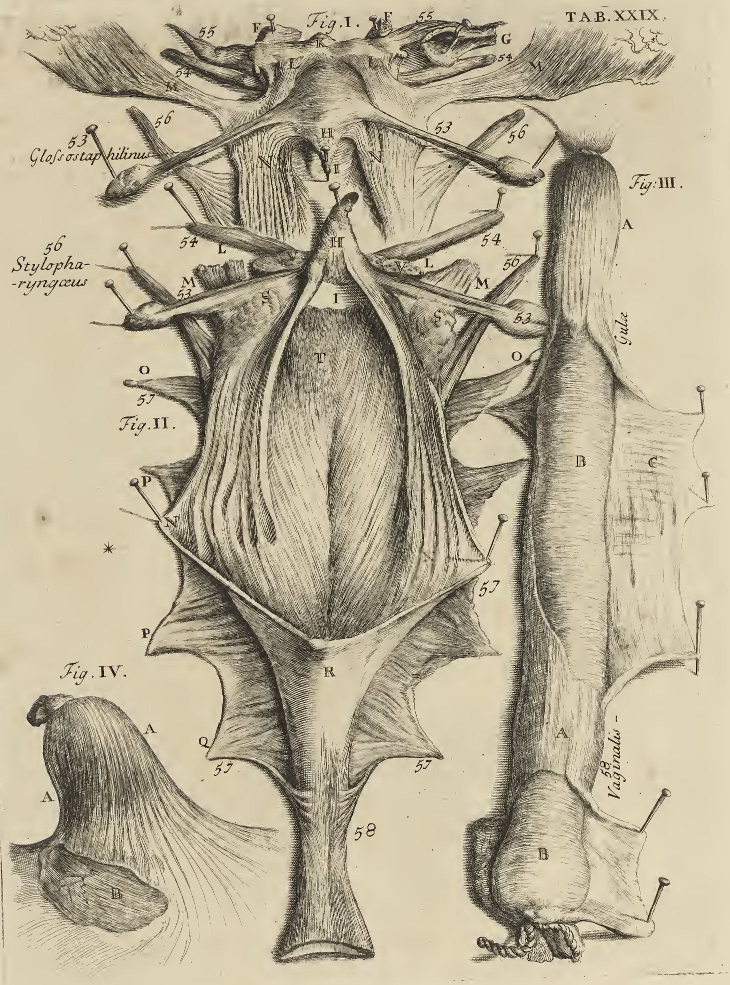


Fig. I.
Fig. II.
Fig: III.
Fig. IV.
53
Glossostaphilinus
56
Stylopha-
-ryngœus
Gula
58 Vaginalis

TAB.XXX.

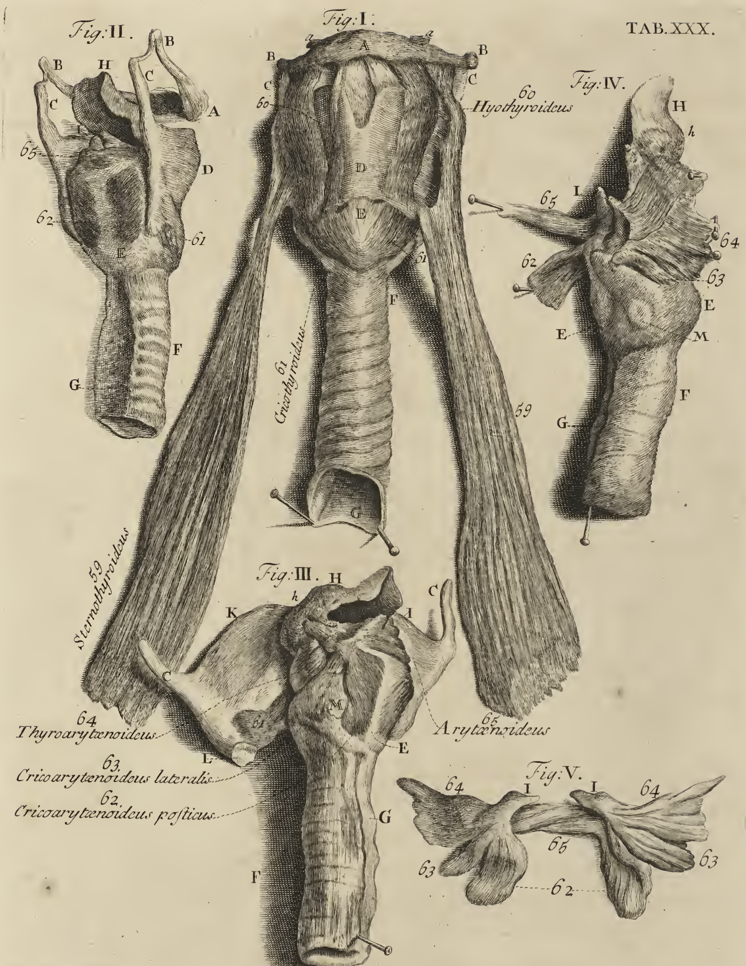


Fig: I.
Fig: II.
Fig: III.
Fig: IV.
Fig: V.
60 Hyothyroideus
61 Cricothyroideus
59 Sternothyroideus
64 Thyroarytænoideus
63 Cricoarytænoideus lateralis
62 Cricoarytænoideus posticus
65 Arytænoideus

TAB. XXX.

FIG. I.

The fore part of the Larynx, *with the* Os Hyoides *and part of the Wind-pipe annex'd, together with all the common Muſcles of the* Larynx.

A The *Os Hyoides.*

a a Its Cartilaginous *Appendices.*

BB The Extremities of the *Cornua* of the *Os Hyoides.*

CC The Proceſſes of the Scutiformal Cartilage. *Vid.* Fig. II.

D The external and fore part of the *Cartilago Scutiformis.*

E The *Cartilago Cricoides*, or *Annularis.*

F The Semicircular Cartilages of the Wind-pipe, which in this Subject (being an emaciated morbid Body) was drawn down to the right Side, by means of a large Ulcer on that Side of the Lungs, that cauſed the Lobes to adhere to the *Thorax* entirely on that Side.

G The Membranous Subſtance on the back part of the Wind-pipe, that is next the *Gula.*

59 The *Sternothyroideus*, cut from its Origination, and left at its Inſertion on each Side.

60 The *Hyothyroideus*, which on the right Side in this Subject was double, as appears in the Figure.

61 The *Cricothyroideus in Situ.* In Fig. III. it is raiſed from the Cricoidal Cartilage, and left at the Thyroidal.

FIG. II. III. IV. V.

Shew different Views of the Larynx, *and its proper Muſcles.*

A, B, C, D, E, F, and G are placed on, or by the ſame Parts, in different Views, with Fig. I. except that G, in Fig. II. ſhews the external Glandulous Surface of the Membrane of the *Aſpera Arteria* next the *Gula.*

H The *Epiglottis.*

h Its Root, cut from the Baſis of the Tongue, where many ſmall Glands appear on it, which are very conſpicuous in the *Epiglottis* of an Ox.

I The Tips of the Arytænoidal Cartilages, here bared of that Membrane, which on theſe Parts frames the *Glottis.*

K Fig. III. The internal concave Surface of the Thyroidal Cartilage.

L Fig. III. The lower ſhort Proceſs of this Cartilage, on the Left Side, freed from its Connexion to the Cricoidal Cartilage expreſs'd at M.

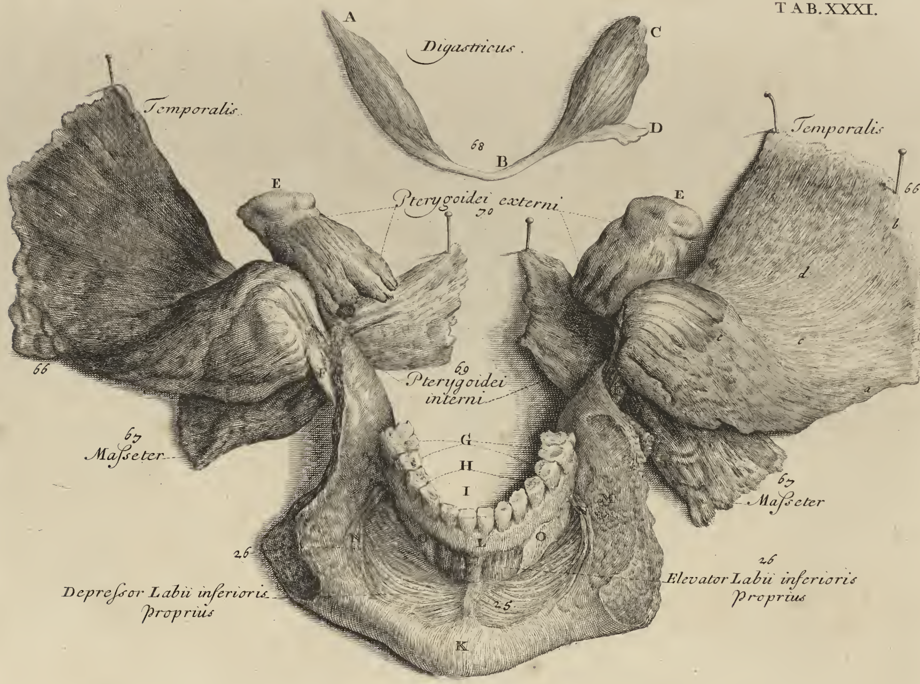
62 The *Cricoarytænoideus Poſticus in Situ,* Fig. II. and III. In Fig. IV. it is raiſed from the Cricoidal Cartilage, and pinn'd out.

63 *Cricoarytænoideus Lateralis in Situ,* Fig. III. and IV.

64 *Thyroarytænoideus, in Situ,* Fig. III. In Fig. IV. it is cut from its Origination, and left at its Inſertion.

65 The *Muſculus Arytænoideus, in Situ,* Fig. II. and III. rais'd and pinn'd out in Fig. IV.

In Fig. V. *all the laſt named Muſcles are diſſected, and left at their Terminations on the Arytænoidal Cartilages.*


A
Digastricus.
C
Temporalis.
Temporalis
D
68
B
66
E
Pterygoidei externi
70
E
b
d
c
66
a
69
Pterygoidei
interni
67
Massseter
G
H
I
67
Masseter
M
N
O
L
26
26
Depressor Labii inferioris
Proprius
25
Elevator Labii inferioris
Proprius
K

TAB. XXXI.

The Muſcles of the lower Jaw, as they appear, when freed from the Cranium.

66 The Inſides of the Temporal Muſcles, where may be ſeen divers fleſhy Fibres of them, as they appear, when cut from the *Os Frontis*, at a, *Sincipitis*, at b, *Sphenoides*, at c, *Temporale*, at d, and *Os Jugale*, at e.

67 The internal Surface of the Maſſeter.

68 The *Digaſtricus*.

A Its Origination from the Chink by the back part of the *Proceſſus Mammiformis*.

B Its middle Tendon, which is braced down by an annular Ligament faſtened to the *Os Hyoides*.

C Its Termination, cut from the lower Jaw.

D Some tendinous Fibres of this Muſcle, cut from the *Os Hyoides*.

69 The internal Surfaces of the *Pterygoidei Interni*.

70 The *Pterygoidei Externi*, hanging down from

EE the Condyloidal Proceſſes of the lower Jaw.

FF The *Proceſſus Acutus*, or *Corone*, partly ſeen.

G The *Dentes Molares*, which remain'd in this Subject.

H The *Canini*.

I The *Inciſores*.

K The lower Lip turned down, to ſhew the Glandulous and Muſcular Texture of its inſide.

L The Gums of the lower Jaw.

M The Labial, or Buccal ſmall Salival Glands, as they appear on the Left Side, after the internal Membrane of that part is raiſed. The Membrane on the other Side here expreſs'd remaining on.

N Branches of the *Par Quintum Nervorum*, accompanied with Blood Veſſels of both kinds, paſſing the Perforations on each Side the lower Jaw, after giving Branches to the Teeth. They diſtribute themſelves on the Lips, eſpecially the lower Lip, as here expreſs'd.

OO The fore part of the lower Jaw bared.

25 The inſide of the *Depreſſor Labii Inferioris*.

26 The *Elevator Labii Inferioris in Situ*.

TAB. XXXII.

71 The Inſide of the *Serratus Minor Anticus.*

A Its Origine, cut from the *Proceſſus Coracoides* of the *Scapula.*

BBB Its three fleſhy Digitations, that terminate on the ſecond, third and fourth Ribs, in the manner you ſee the Ends of the fleſhy Fibres here expreſs'd, cut off, ✝ ✝ ✝.

72 The Inſide of the *Serratus Major Anticus.*

AC That part of it, that ſprings from the *Baſis Scapulæ,* below its Spine: from A to D is that part, that has its Origine above the Spine of the *Scapula.*

B The upper part of this Muſcle, which is ſeen between the *Cucullaris, Scaleni, Levator Scapulæ,* and *Clavicularis,* as expreſs'd Tab XXII. at 72.

EF The Digitations of this Muſcle, cut from the 8th, 7th, 6th, 5th, 4th, and 3d Ribs.

GG That part of it, which terminated on the firſt and ſecond Ribs.

H Its Arteries, filled with Wax.

71
Serratus minor
Anticus

Serratus major
Anticus
72

TAB. XXXIII.

Fig. I.

TAB. XXXIII.

73 The *Subclavius* diffected.

A The flefhy Part of it, that fprings from the *Clavicula*.

B Its round Tendon, with part of the Cartilage of the firft Rib cut off.

74 The Infide of the *Scalenus Primus*.

A Its flefhy Origine from the fourth, fifth, and fixth tranfverfe Proceffes of the Neck.

B Its Termination, cut from the firft Rib.

75, 76 The Outfides of the *Scalenus Secundus*, and *Tertius*.

A Their flefhy Beginnings from the third, fourth, fifth and fixth tranfverfe Proceffes of the *Vertebræ* of the Neck.

B Their common Tendon in this Subject, cut from the firft Rib.

FIG. I.

The Infide of the Sternum, *with the Cartilaginous Endings of the Ribs, freed from their Bony Parts.*

AA The Cartilaginous Endings of the two upper Ribs, which are conftantly longer than the two next below them, as here exprefs'd.

BB Two Sinus's, where the Extremities of the *Claviculæ* are articulated, by the mediation of two moving Cartilages.

CC Part of the *Par Sternothyroideum*.

DD The Mammary Arteries and Veins.

EE The Infide of the *Os Pectoris*, or *Sternum*.

F The *Cartilago Enfiformis*.

GG The Cartilaginous Endings of the Ribs, cut from their Bony Parts.

77 The *Mufculus Triangularis*, on each Side.

79 The internal Intercoftal Mufcles.

H Part of the Diaphragm.

FIG. II.

A Sketch of the internal Surface of two or three of the lower Ribs, near their Articulations with the Vertebræ *of the Back, as big as the Life; where a Difpofition of the internal Intercoftal Mufcles, not commonly taken notice of, is reprefented.*

79, 79 The *Intercoftales Interni*.

AA The tendinous Original of divers Slips of the internal Intercoftal Mufcles, fpringing from the inferiour Ribs, and afcending obliquely over the next fuperiour Rib at E, where they become broader and flefhy, being join'd with flefhy Slips from the fubjacent intercoftal Mufcles at C, and terminating in the next Rib above at B.

This Difpofition of the internal Intercoftal Mufcles is continued on all the Ribs, on both fides the *Thorax* in human Bodies, and not in thofe Quadrupeds, that I have hitherto examin'd. The way of difcovering this, is by raifing the *Pleura*, which may eafily be done by your Fingers, after it is divided from the *Mediaftinum*, on the Bodies of the *Vertebræ* of the *Thorax*.

DD Parts of the external Intercoftal Mufcles, bared from the Internal.

TAB. XXXIV.

78 The upper Surface of the Diaphragm, next the *Thorax*.

A The Right Side.

B The Left.

C That part of the Diaphragm, which ariſes from the *Cartilago Enſiformis*.

DEF Thoſe Parts, that ariſe from the *Vertebræ* of the Loins.

GG From the two laſt Ribs.

HH From the Cartilaginous Endings of the Ribs next the *Abdomen*; whence its fleſhy Fibres paſs, till they become tendinous, II, where they decuſſate each other in various Angles, according to their ſeveral Directions, from their different Originals at A, B, C, D, E, F, G, H. Nor do they ſeem to terminate here, but each tendinous Fibre is continued to its oppoſite fleſhy one, making as it were ſo many Digaſtrick Muſcles, in which are two conſiderable Perforations; the one for

K The *Vena Cava*, the other for

L The *Gula*.

M A Portion of the Trunk of the *Arteria Magna*, in the Fiſſure of the two Productions of the Diaphragm, where the *Vena ſine pari* and the Thoracick Duct alſo paſs.

TAB. XXXIV.

Diaphragma

78.

Diaphragma 78 TAB. XXXV.

TAB. XXXV.

78 The lower Surface of the Diaphragm, next the *Abdomen*.

A, B, C, D, E, F, G, H, I, K, L, Are deſcrib'd in the Explication of the preceding Table.

M The Fiſſure, made by its two Productions, in which paſſes the deſcending Trunk of the *Arteria Magna*, &c.

N N The Phrenick Veins and Arteries, fill'd with Wax.

O Some Phrenick Arteries, that ſpring from the Intercoſtal Arteries.

TAB. XXXVI.

Divers Views of the external, middle, and internal Compages of the Fibres of the Heart.

FIG. I.

The fore part of the Heart, next the Sternum.

A The inferiour Trunk of the *Vena Cava.*

B The *Arteria Pulmonalis.*

C, C, C The *Vena Pulmonalis,* with its Branches tied up.

D The *Arteria Magna.*

a The *Ligamentum Arteriosum,* between the Pulmonick Artery and the *Aorta.*

b The Trunk of the *Arteria Coronalis.*

E The right Auricle distended, to shew the Series of its Muscular Fibres.

F The Left Auricle.

G The oblique descending Progress of the Muscular Fibres of the right Ventricle of the Heart.

H The oblique ascending Progress of the carnous Fibres of the left Ventricle.

I I The tendinous Union of both these on the *Septum* of the Heart.

FIG. II.

The back part of the Heart, next the Vertebræ.

A The lower, or ascending, Trunk of the *Vena Cava.*

a a The circular Fibres appearing on its inside.

B A Portion of the upper, or descending, Trunk of the *Cava.*

b The *Vena Coronaria.*

C The *Vena Azygos* tied up, where it discharges it self into the *Cava.*

D D The right Auricle, representing the various Disposition of its Fibres.

E Part of the Root of the left Auricle *in Situ.*

G The Muscular Fibres on the bulbous Trunk of the *Vena Pulmonalis.*

F F Two of its Ramifications from the Lungs, tied up.

H The Fibres of the right Ventricle.

I Those of the left Ventricle.

K K Their tendinous Union, on the *Septum Cordis.*

L The *Foramen Ovale,* somewhat appearing.

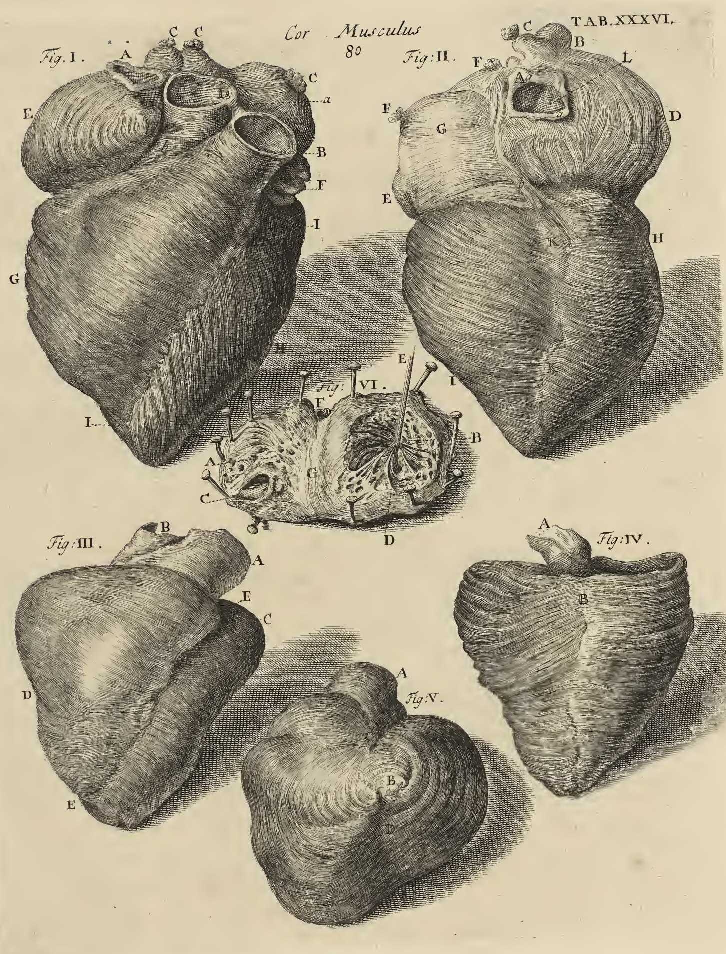

Cor Musculus
80
TAB. XXXVI.
Fig. I.
Fig: II.
Fig: III.
Fig: IV.
Fig: V.
Fig: VI.

FIG. III.

The Series of Fibres, under thoſe repreſented in Fig I.

A Part of the *Arteria Pulmonalis.*

B A Portion of the *Aorta.*

C The Fibres of the left,

D Thoſe of the right Ventricle of the Heart.

EE The tendinous Union of the carnous Fibres of both Ventricles.

FIG. IV.

The Fibres, as they appear, under thoſe expreſs'd in Fig. II.

A Part of the *Aorta.*

B The tendinous Union of the Fibres of both Ventricles.

FIG. V.

The Double Spiral Order of the Fibres, at the Cone of the Heart, which may partly be ſeen in Fig. III.

A Part of the *Arteria Pulmonica.*

B The Contortion of the Fibres, at the Cone of the Heart.

CD The tendinous Union of both Ventricles.

FIG. VI.

A View of the internal Surface of the Cone of the Heart, after a tranſverſe Section.

A The Bottom of the right Ventricle.

B That of the left.

C The Thickneſs of the Sides of the right Ventricle.

D That of the left.

E A Thread, ſupporting the tendinous Fibres, that paſs from one Side of the left Ventricle to the other.

F The Trunks of the Coronary Vein and Artery divided.

G The tendinous Union of both Ventricles.

Tab. XXXVII.

Fig. I.

The right Auricle and Ventricle of the Heart, open'd from the Vena Cava.

A The Body of the Heart, with its Blood Veſſels filled with Wax.

a Its Cone.

BB The aſcending Trunk of the *Vena Cava* opened.

bb That part of the right Auricle, that is divided from the aſcending Trunk of the *Cava.*

C The deſcending Trunk of the *Cava,* alſo open'd and expanded.

c The Orifices of Veins, that bring Blood from the Auricles, and Trunks of Blood Veſſels at the *Baſis* of the Heart.

DD The Inſide of the right Auricle.

d A ſmall Semilunar Valve, as it appears in the lower Trunk of the *Vena Cava,* in this Poſition. See Fig. II.

EEE The Sides of the right Ventricle divided.

F One of the carnous Columns, to which the Tricuſpid Valve is faſten'd.

f Some fleſhy Fibres paſſing from the inſide of the Ventricle to the Tricuſpid Valve.

GG The Tricuſpid Valve, as it appear'd in this Poſition.

H A Valve pinn'd up, at the Orifice of the Coronary Vein.

II A bended Probe, paſſing through the *Foramen Ovale,* K, into the *Vena Pulmonalis,* L, which remain'd open in this Subject, who died conſumptive about 30 Years of Age.

MM A Black Lead Pencil, ſupporting the Tricuſpid Valve, and paſſing out at the right Branch of the *Arteria Pulmonalis,* N.

O The left Branch of the *Arteria Pulmonalis.*

P Divers carnous Fibres, which ariſing from the *Septum Cordis,* paſs to the oppoſite Side of the right Ventricle, and draw it cloſe to the *Septum,* when the Heart is *in Syſtole.*

Fig. II.

A Portion of the lower Trunk of the Vena Cava, *diſſected and diſplay'd, with the Parts annex'd, to ſhew the Valve expreſs'd at* d, Fig. I.

AA The Trunk of the *Vena Cava,* cut off immediately above the Liver, at its paſſing the Perforation of the Diaphragm.

B A Portion of the Diaphragm.

C, C Two Pins, with Threads paſſed through the Edge of the Semilunar Valve, as I call it from its Figure in this and moſt other Subjects, to ſhew the Extent of this Valve.

EE Part

80

Fig. I.

Fig. II.

Fig. III.

EE Part of the *Cava* cut from the *Basis* of the Heart.

D The *Vestigium* of the *Foramen Ovale,* which in this Subject, tho' very young, was closed.

FIG. III.

Shews the same Valve, express'd in the two former Figures, at d, *and* CC, *as I found it in the* Vena Cava *of a Man near* 80 *Years of Age, in whom I first observ'd it, done from a dried Preparation, which I have now by me.*

AA The Trunk of the *Vena Cava,* cut off immediately above

BB The Diaphragm.

CC The Valve, which in this Subject appears, as here express'd, full of Perforations of various Sizes and Figures.

D A lucid Membrane not perforated, in the place of the *Foramen Ovale.*

EE The Trunk of the *Vena Pulmonalis* open'd and expanded.

a The Orifice of a large Vein, that empties it self into the *Vena Cava,* near the right Auricle.

b The Branches of Arteries, from whence the Blood is received, that is discharg'd by the Vein last mention'd.

TAB. XXXVIII.

FIG. I.

The ſame Heart, repreſented at Fig. I. *in the preceding Table, with the right Ventricle open'd from the* Arteria Pulmonalis, *both being here pinn'd out and diſplay'd, as big as the Life.*

A The external Surface of the Heart, near its Cone, with its Blood Veſſels (a a a) fill'd with Wax.

BB The Sides of the right Ventricle, divided and pinn'd out, to ſhew its internal Surface, leading into the *Arteria Pulmonalis.*

CC The Trunk of the Pulmonick Artery open'd, and in like manner expanded.

D, E Its right, and left Branches, alſo open'd and cut off at their Entrance into the Lungs.

c c c The three Semilunar Valves, one of which is ſupported with a Probe.

d A large fleſhy Column, ariſing from the oppoſite Side of the right Ventricle, here ſupported on the Head of a large Pin, f, to ſhew its Tendons paſſing to the lower Margin, and ſides of the Tricuſpid Valve, e.

By means of the ſeveral *Foramina,* Fiſſures, and fleſhy Columns, in this Ventricle, its Sides contract the cloſer in the *Syſtole,* in order to the better Expulſion of its contain'd Blood into the Arteries of the Lungs.

F The Trunk of the *Aorta* cut off.

G The Deſcending Trunk of the *Vena Cava.*

H Part of the right Auricle.

FIG. II.

The Mitral Valve of the left Ventricle, diſſected and diſplay'd.

a The upper part of the Valve, freed from its connexion to the *Baſis* of the Heart, at the Orifice of the *Vena Pulmonica.*

bb Its lower Margin, which hangs down into the Cavity of the left Ventricle, to which ſome Tendons, as here expreſs'd, ariſing from the carnous Columns, are faſt'ned; which Tendons, being equal in length with thoſe, that paſs to the middle and upper part of the Valve, at e e, muſt admit of the lower Edges of this Valve to fold on each other, whereby the Orifice of this Valve is effectually cloſed, when the Heart is *in Syſtole,* while the middle and upper part of the Valve, at e e, is drawn down with the *Baſis* of the Heart, towards its Cone.

c c c The *Columnæ Carneæ,* cut from the Sides of the Ventricle; from which the above-mention'd Tendons ariſe.

dd Two of the tranſverſe Tendons, between the carnous Columns.

TAB. XXXVIII.

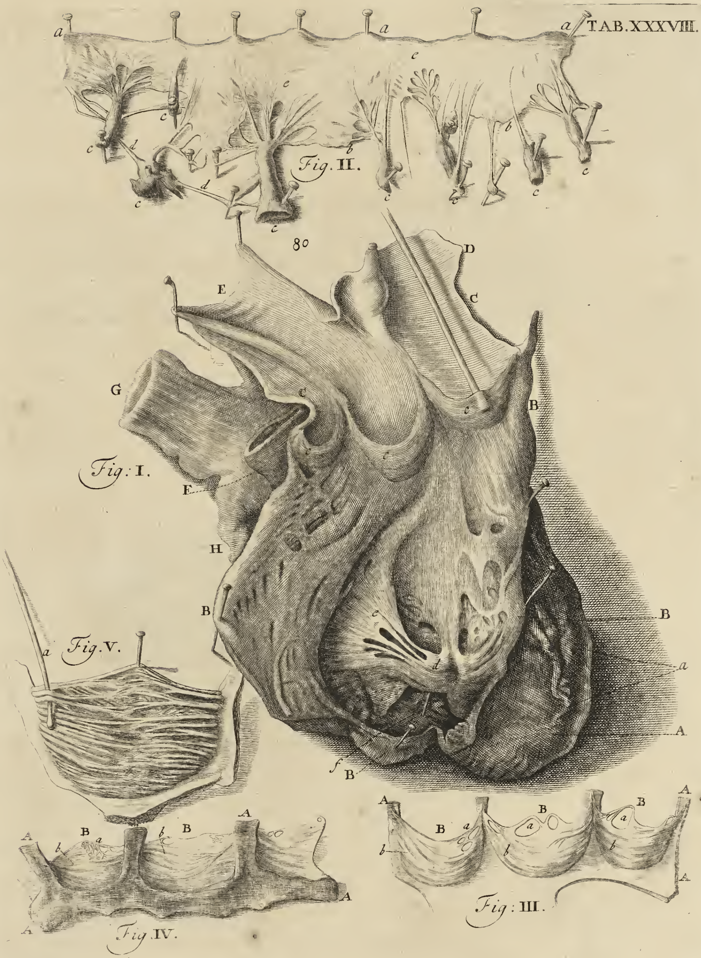


FIG. III.

The internal Surface of the three Semilunar Valves of the Pulmonary Artery, next the Cavity of the right Ventricle of the Heart.

FIG. IV.

The external Surface of the ſame Valves, next the Trunk of the Pulmonick Artery.

AA Parts of the Artery left, after the reſt are cut away, to ſhew the Structure of the Valves.

BB The Valves as I have frequently found them, with Perforations of various Sizes, a a.

bb The carnous *Fibrillæ* of theſe Valves, which appear almoſt as plain, as here expreſs'd, to the naked Eye; but on the external Surface of theſe Valves in an Ox, *i. e.* next the Trunk of the Artery, you will find theſe carnous Fibres variouſly interwoven, and ſuch large muſcular Bodies, that you may thruſt a Probe underneath them, without wounding the internal Surface of the Valve, as expreſs'd at a. Fig. v.

TAB. XXXIX.

FIG. I.

The Left Ventricle of the Heart open'd, with the Trunk of the Vena Pulmonalis, *and the Left Auricle.*

A The Cone of the Heart.

BB The Sides of the Left Ventricle divided, to ſhew its internal Surface.

ab The Trunks of the Coronary Veins and Arteries, fill'd with Wax, and cut through, at the *Baſis* of the Heart.

CC The Trunk of the Pulmonick Vein, divided and expanded.

DD The Left Auricle of the Heart, partly open'd, at e e, to ſhew its internal Surface.

E A ſmall Probe, and a Pencil inſerted into the Branches of the Pulmonick Vein.

F Another Pencil ſupporting the Mitral Valve.

gg The Muſcular Columns, which ſend Tendons to the Valve.

h A tendinous Production from each Carnous Column, which not only ſerves for approaching thoſe Parts nearer to each other in the *Syſtole*, and ſtraitning the Cavity of the Ventricle, in order to expel the Blood into the *Aorta*; but in the *Diaſtole* of the Heart it prevents too great a Dilatation of the Sides of the Ventricle, by the influent Blood.

i The way the Blood paſſes to the *Aorta*, behind the Mitral Valve.

I A Probe paſſing the *Foramen Ovale*, between the Right Auricle and *Vena Pulmonalis*.

K Part of the *Vena Cava*.

FIG. II.

The external Paries *of the Left Ventricle, cut off from the* Baſis *of the Heart, at the Root of the* Arteria Magna, *to the Cone, according to the length of the Heart.*

A The Beginning of the *Arteria Magna*.

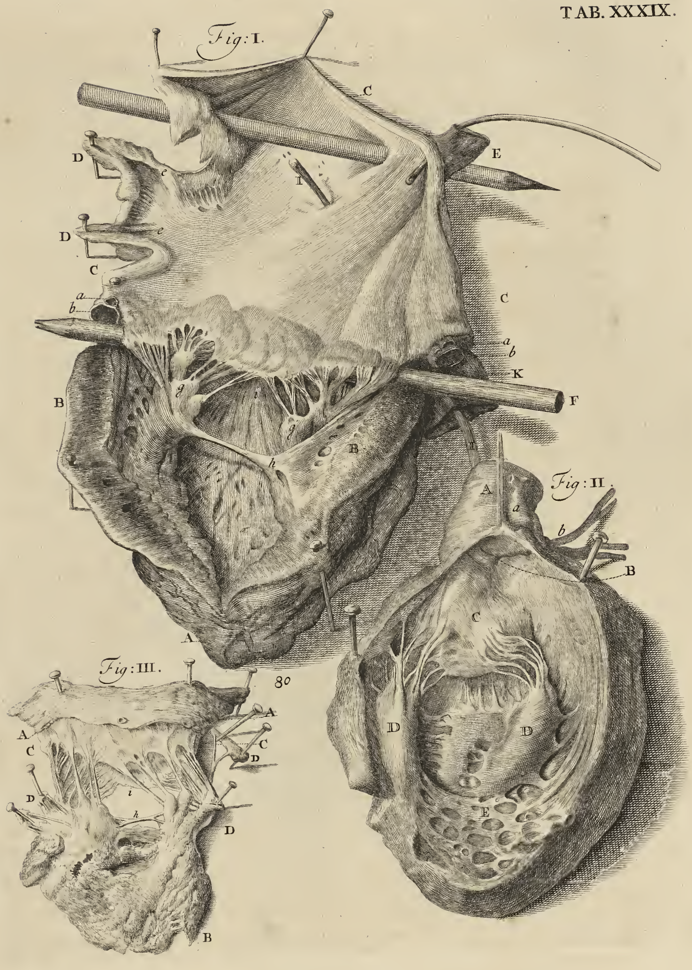
ab Some of the Trunks of the two Coronary Arteries, freed from the Heart and cut off.

B The Valves of the *Aorta*, as they appear'd towards the Left Ventricle.

C The outſide of part of the Mitral Valve, with the Tendons deriv'd from the two *Columnæ Carneæ* variouſly terminating on it, as is expreſs'd Fig. II. of the preceding Table.

DD The *Columnæ Carneæ*, deriving their Origine from a Center on the Side of the Left Ventricle of the Heart next its *Septum*, at E, whereby they not only draw the part of the Mitral Valve here expreſs'd towards the *Septum*, and conſequently bring this Side of the Mitral Valve to the other, but by this means make way for the Blood to paſs out at the *Aorta*, as may be eaſily conceiv'd by this Figure. Beſides the

TAB. XXXIX.



the Tendons ſent from the *Columnæ Carneæ* to the Mitral Valve, we meet with many other Tendons, alſo ſent from the Carnous Columns to the Sides of the Ventricle; particularly ſome paſs up to the *Baſis* of the Heart, as may be ſeen in this Figure.

FIG. III.

The Mitral Valve taken out entire, with the Columnæ Carneæ *and their annex'd Tendons*, &c.

AA The fleſhy Fibres at the *Baſis* of the Heart cut off.

B Part of the fleſhy Fibres cut from the *Septum*, towards the Cone of the Heart, whence the *Columnæ Carneæ* take their Riſe.

CC The external Surface of the Mitral Valve, to which the Tendons deriv'd from the *Columnæ Carneæ* are variouſly inſerted.

DD Divers Tendons ſpringing in like manner from the *Columnæ Carneæ*, cut from the Sides of the Ventricle.

h A tranſverſe Tendon between the *Columnæ Carneæ*.

i The oppoſite part of the Mitral Valve, expreſs'd at C, Fig. II. next the Orifice of the *Aorta*.

TAB. XL.

FIG. I.

The Left Ventricle of the Heart opened, together with the Vena Pulmonalis *and Trunk of the* Aorta, *to ſhew in one View the Poſition of the Valves, that hinder the Return of the Blood by the ſame way it came into the Ventricle, as well as thoſe Valves, that prevent the return of the Blood, after it is expell'd from thence by the* Syſtole *of the Heart.*

AA The Sides of the Heart divided, from its Baſis, where the *Aorta* and *Vena Pulmonalis* paſs by each other, to

B The Cone of the Heart.

C, C, D The large bulbous Trunk of the *Vena Pulmonalis*, open'd and pinn'd out.

E The Orifice, that leads into the Left Auricle.

F The external Surface of the Left Auricle of the Heart.

GG A Probe ſupporting the Mitral Valve, whereby the Tendons ſpringing from the *Carneæ Columnæ* are made very conſpicuous, and the uſe of the Poſition of thoſe Organs, mention'd in the Explication of Fig. II. of the preceding Table, farther illuſtrated.

gg The divided Sides of the Mitral Valve.

hh Divers tranſverſe tendinous and fleſhy Fibres, appearing in this Poſition, in the Left Ventricle of the Heart.

I The internal Surface of the Left Ventricle, leading to the *Aorta*, which is ſmooth, for the more eaſy Aſcent of the Blood that way to the *Aorta*.

KK The *Aorta* cut off and expanded.

L An Ear Scoop, ſupporting one of the Semilunar Valves of the *Aorta*.

l, *l* The other two Semilunar Valves, as they appear in this Poſition.

M The Trunk of the *Arteria Pulmonalis*, cut off.

FIG. II.

Is drawn from the ſame Heart expreſs'd Fig. I. *in the preceding Table, after dividing the* Vena Pulmonalis, *through the middle, (as 'tis there repreſented) together with the* Arteria Aorta.

AA The *Aorta* cut off near the *Baſis* of the Heart, and ſlit open and diſplay'd.

B, B The bulbous Trunk of the *Vena Pulmonalis* divided through, with part of the *Aorta* annex'd to it, and pinn'd aſide, to ſhew

aaa The


Fig: I.
Fig: II.
Fig: III.
Fig: IV.
Fig: V.
Fig: VI.

aaa The three Semilunar Valves of the *Aorta*, which prevent the return of the Blood from thence, after its Expulsion from the Left Ventricle, g g, by the *Systole*, or Contraction of the Heart.

b A Petrefaction, that grew at the Conjunction of these two Valves in this Subject, whereby they were thickned and incommoded in the due Execution of their Office; whence it happened (some time before the Death of the Person to whom this Heart belong'd) that the *Systole* was interrupted, as appear'd by the Inequalities of his Pulse, sometimes missing one Stroke in ten; but when the Blood happen'd to be any ways quicken'd in its Motion, whether by any agitation of Body or Mind, these Interruptions became more frequent, especially near the latter end of his Life, which was before he arriv'd to the Age of thirty three Years. This Petrefaction not appearing to view so plain, as when the Parts about it were dried, it is therefore express'd at †, where the same Letters are placed on it and Parts of the two Valves annex'd, as in the great Figure. See *Philos. Transactions*, N° 299. p. 1970, &c.

C Part of the lower Trunk of the *Vena Cava*, cut off immediately above the Liver.

c c The Left Auricle of the Heart open'd from the *Vena Pulmonalis*, and pinn'd out.

D D The Sides of the Left Ventricle divided and drawn aside, to shew its Cavity at d d, e e, f, g g.

d d Part of the Mitral Valve, divided and drawn to each Side.

e e The *Columnæ Carneæ*.

f The Transverse Chord mention'd at h, in Fig. 1. of the preceding Table.

g g The internal smooth Surface of the Left Ventricle near the Orifice of the *Aorta*.

h The Coronary Vein, and

i The Coronary Artery divided.

k One of the Branches of the *Vena Pulmonalis*.

l l Orifices of other Branches, as they appear opening into the bulbous Trunk of that Vein.

FIG. III.

Part of the Aorta *cut off next the* Basis *of the Heart, to shew its Valves, as they appear next the Ventricle, when the Heart is* in Diastole, *and the Blood hinder'd by them in its return from the* Aorta *to the Left Ventricle, after its Expulsion from thence.*

A Part of the *Aorta* cut off immediately above the *Basis* of the Heart.

c Part of one of the Coronary Arteries.

d The meeting of the middle Parts of the three Valves in the Center of the Orifice of the *Aorta*.

e e e The three Semilunar Valves, as they appear, when the Blood in the great Artery presses them together, whereby they hinder its return into the Left Ventricle.

g g Part of the Mitral Valve.

h Its Orifice, by which the Blood flows from the *Vena Pulmonalis* into the Left Ventricle of the Heart.

FIG. IV.

A Portion of the Aorta, *with the Parts annex'd, in the ſame Poſition, as was repreſented in the preceding Figure, taken from a morbid Body, in which the uſe of the Semilunar Valves was entirely defeated by a large Petrefaction, that grew upon them.*

A The Trunk of the *Aorta*, cut from the *Baſis* of the Heart.

d A large triangular Aperture, which always remain'd open by reaſon of

e, e, e The Petrefaction of the three Semilunar Valves.

f A Petrefaction of the *Valvula Mitralis.*

g, g The Mitral Valve, which was very much ſtiffned in this Subject.

h Its Orifice, as above-mention'd.

i, i, i Carnons Columns taken out and diſplay'd, to ſhew the Tendons ariſing from them, and terminating variouſly, as expreſs'd at l, l, on the Mitral Valve.

k k Divers tranſverſe Tendons, that help to approach the fleſhy Columns to each other in the *Syſtole.*

FIG. V. VI.

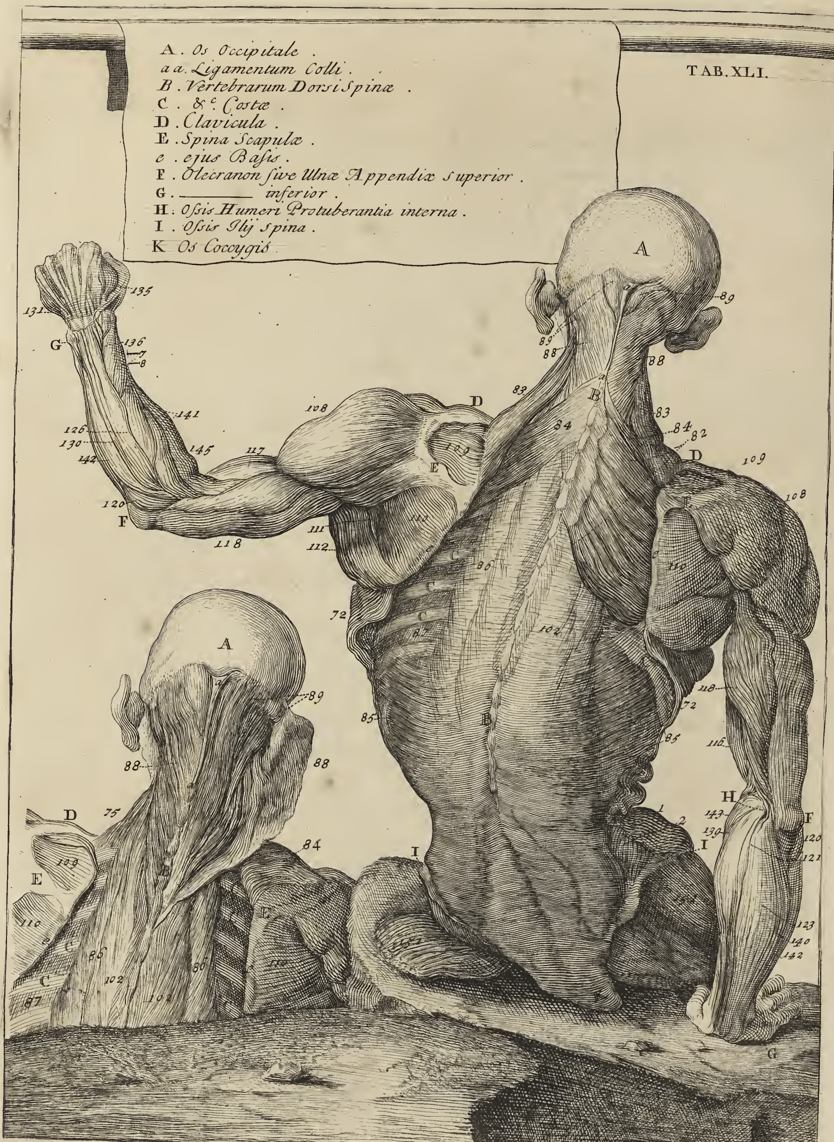
Shew the ſame Parts of the Aorta, *with its Valves viewed from the great Artery towards the Heart.*

N. B. The ſame Letters of Reference, with thoſe of the two preceding Figures, ſerve to both, except Fig. VI.

b The Trunk of one of the Coronary Arteries.

c The Aperture of the other Coronary Artery, the Trunk of which happen'd to be cut off in the Diſſection from the Heart.

TAB.


TAB. XLI.
A. Os Occipitale.
a a. Ligamentum Colli.
B. Vertebrarum Dorsi Spinæ.
C. &c. Costæ.
D. Clavicula.
E. Spina Scapulæ.
e. ejus Basis.
F. Olecranon sive Ulnæ Appendix superior.
G. ——— inferior.
H. Osis Humeri Protuberantia interna.
I. Osis Ilij Spina.
K. Os Coccygis.

TAB. XLI.

The Parts here represented, being sufficiently explain'd by the References engrav'd on the Plate, and the general Table of the Muscles, we shall add no other Description.

TAB.

TAB. XLII.

81 The Inſide of the *Cucullaris*, of the right Side.

A That part of it, that ſprings from the *Occiput*,

B From the *Ligamentum Colli*,

CD From the eight ſuperiour Spines of the *Vertebræ* of the *Thorax*.

EE Its fleſhy Termination cut from the *Clavicula*.

FG Its fleſhy and tendinous ending in the Spine of the *Scapula*.

H The Trunks of its Blood Veſſels.

82 The internal Surface of the *Rhomboides*, of the left Side.

IK Its tendinous Origine, from the *Ligamentum Colli*, and the Spine of the lowermoſt *Vertebra* of the Neck.

KL From the four ſuperiour Spines of the *Vertebræ* of the *Thorax*.

MM Its fleſhy Termination, cut from the *Baſis Scapulæ*.

83 The *Levator Scapulæ*, of the right Side.

NNNN Its four partly tendinous, and partly fleſhy Originations, cut from the tranſverſe Proceſſes of the firſt, ſecond, third and fourth *Vertebræ* of the Neck.

O Its Ending, cut from the ſuperiour Angle, and part of the Baſis, of the *Scapula*.

84 The internal Surface of the *Serratus Superior Poſticus*, of the left Side.

P Its tendinous Origine, cut from the Spines of the *Vertebræ* of the Neck and *Thorax*.

2, 3, 4, 5 Its fleſhy Terminations on the ſecond, third, fourth, and fifth Ribs.

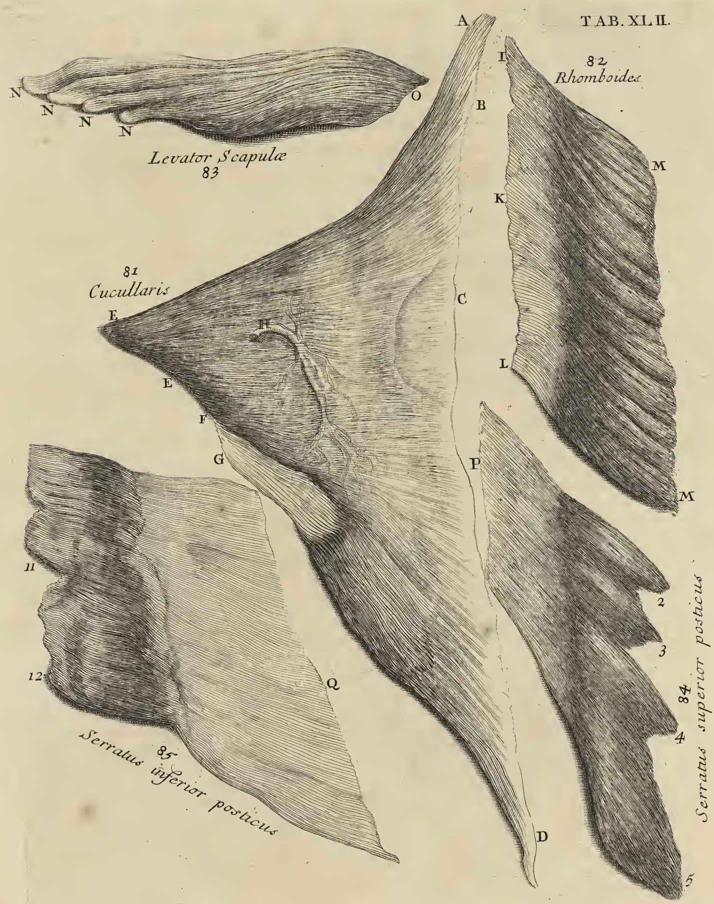
85 The external Surface of the *Serratus Inferior Poſticus*, of the left Side.

Q Its tendinous Part, freed from the Spines of the *Vertebræ* of the *Thorax* and Loins, as well as from the *Dorſi Latiſſimus*, to which it firmly adheres.

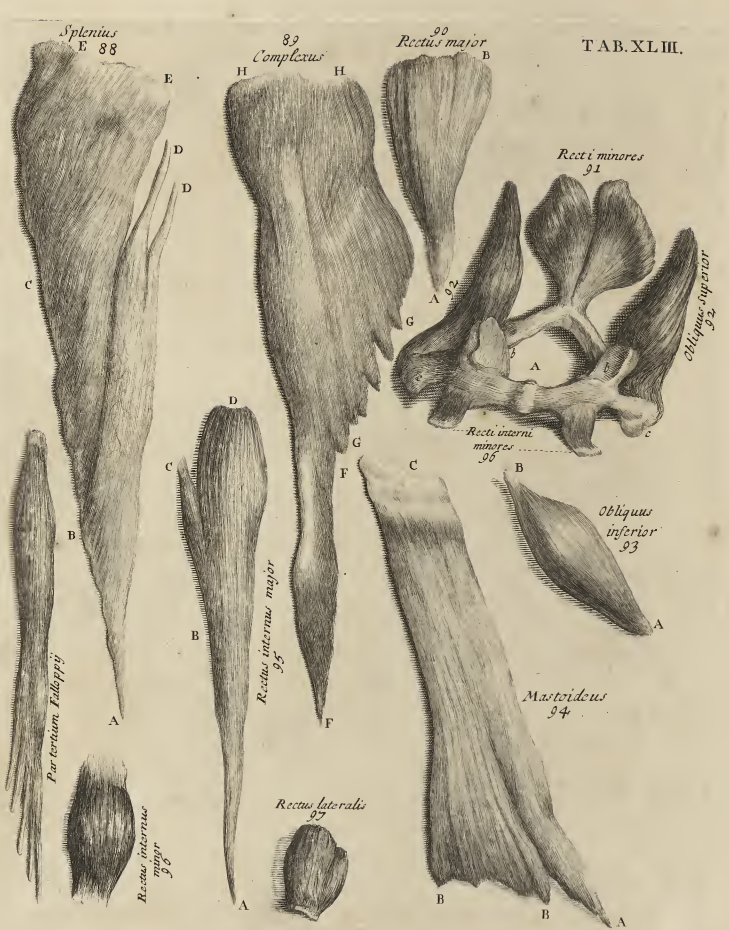
11, 12 Its fleſhy Terminations, freed from the lower Ribs.

TAB.

TAB. XLII.


82
Rhomboides
Levator Scapulæ
83
81
Cucullaris
Serratus superior posticus
84
85
Serratus inferior posticus
A
B
C
D
E
E
F
G
H
I
K
L
M
M
N
N
N
N
O
P
Q
2
3
4
5
11
12

TAB. XLIII.


Splenius
88
89
Complexus
90
Rectus major
Recti minores
91
Obliquus superior
92
Recti interni
minores
96
Obliquus
inferior
93
Mastoideus
94
Rectus internus major
95
Par tertium Falloppij
Rectus internus
minor
96
Rectus lateralis
97

TAB. XLIII.

88 The external Surface of the *Splenius*, of the right Side.

AB Its lower part, which appears diſtinct in ſome Subjects, and may be truly reckon'd a Muſcle of the Neck, ariſing from the Spines of the *Vertebræ* of the *Thorax*.

BC That part of this Muſcle, that ſprings from the Spines of the *Vertebræ* of the Neck.

DD The two Tendons of its lower part, which terminate in the tranſverſe Proceſſes of the firſt and ſecond *Vertebræ* of the Neck.

EE Cut from its Implantation on the *Occiput*.

89 The exteriour Face of the *Complexus* of the ſame Side.

FF Springs from the ſix ſuperiour tranſverſe Proceſſes of the *Vertebræ* of the *Thorax*.

GG Are its partly tendinous and partly fleſhy Originations, from the ſix inferiour tranſverſe Proceſſes of the *Vertebræ* of the Neck.

HH That part, which terminates on the *Os Occipitis*.

90 The *Rectus Major*, of the right Side.

A Its narrow Original, cut from one part of the double Spine of the ſecond *Vertebra* of the Neck.

B Its broad end, implanted on the *Os Occipitis*.

91 The *Recti Minores*, cut from their Inſertions at the *Occiput*, and left at their Origine, at the back part of the firſt *Vertebra* of the Neck.

A The firſt *Vertebra* of the Neck.

bb Its two Proceſſes, that are articulated with thoſe of the *Occiput*.

cc Its tranſverſe Proceſſes, whence the *Recti Laterales* ariſe.

92 The *Obliquus Superior*, cut from the *Occiput*, and left at its Origine from the back part of the tranſverſe Proceſs of the firſt *Vertebra* of the Neck.

93 The *Obliquus Inferior*.

A Its Origine, from the Spine of the ſecond *Vertebra* of the Neck.

B Its Termination, at the tranſverſe Proceſs of the firſt *Vertebra*.

94 The outſide of the right *Maſtoideus*.

A That part of it that ſprings tendinous from the *Sternum*.

BB From the *Clavicula*.

C Its broad tendinous Ending, cut from the back part of the *Proceſſus Mammillaris*, and the adjoining part of the *Os Occipitis*.

95 The external Surface of the *Rectus Internus Major*, of the left Side.

AB That part of it which ariſes from the *Vertebræ* of the Neck.

C A part of this Muſcle, that in this Subject was inſerted into the tranſverſe Proceſs of the firſt *Vertebra* of the Neck.

D That part of it, that was cut from the anteriour *Appendix* of the *Os Occipitis*.

96 The *Rectus Internus Minor*.

97 The *Rectus Lateralis*.

TAB. XLIV.

FIG. I.

The back Parts of the Vertebræ *of the Neck, as they appear'd in a late Subject, with the Muſcles and Parts annex'd, as big as the Life.*

A The *Os Jugale.*

B The *Proceſſus Maſtoides.*

C The *Meatus Auditorius,* as it appears, after the *Auricula* is cut off.

D The ſhallow Cavity, that receives the Head of the *Proceſſus Condyloides* of the lower Jaw-bone.

E The external Surface of the *Ala Veſpertilionis* of the *Os Sphenoides,* where the *Muſculus Pterygoideus Internus* does ariſe.

F The *Proceſſus Pterygoides,* on which the Tendon of the *Pterygoſtaphylinus* paſſes.

G The fourth Bone of the upper Jaw, where it makes the external *Paries* of the *Antrum Maxillæ Superioris.*

H That part of the ſame Bone, which makes the roof of the Mouth, here cover'd with the glandulous Membrane of the Palate.

I The Glands, as they appear'd, where the *Uvula* was cut off.

K The *Septum Narium,* towards the *Fauces.*

L The *Os Occipitale.*

91 M The *Recti Minores.*

N The *Rectus Lateralis.*

♆ The *Proceſſus Styloides.*

O O A round, ſlender, and long Muſcle, which I found in this Subject, ariſing from the Spinal Proceſs of the ſixth *Vertebra,* and ending in that of the ſecond *Vertebra* of the Neck; but this I have obſerv'd is wanting in moſt Subjects.

1, 2, 3, 4, 5, 6, 7 The back Parts of all the *Vertebræ* of the Neck.

a The tranſverſe Proceſs of the firſt *Vertebra* of the Neck.

b A riſing in the back Part of this *Vertebra,* which makes the *Sinus,* that receives the oblong Proceſs of the *Os Occipitale* on that ſide.

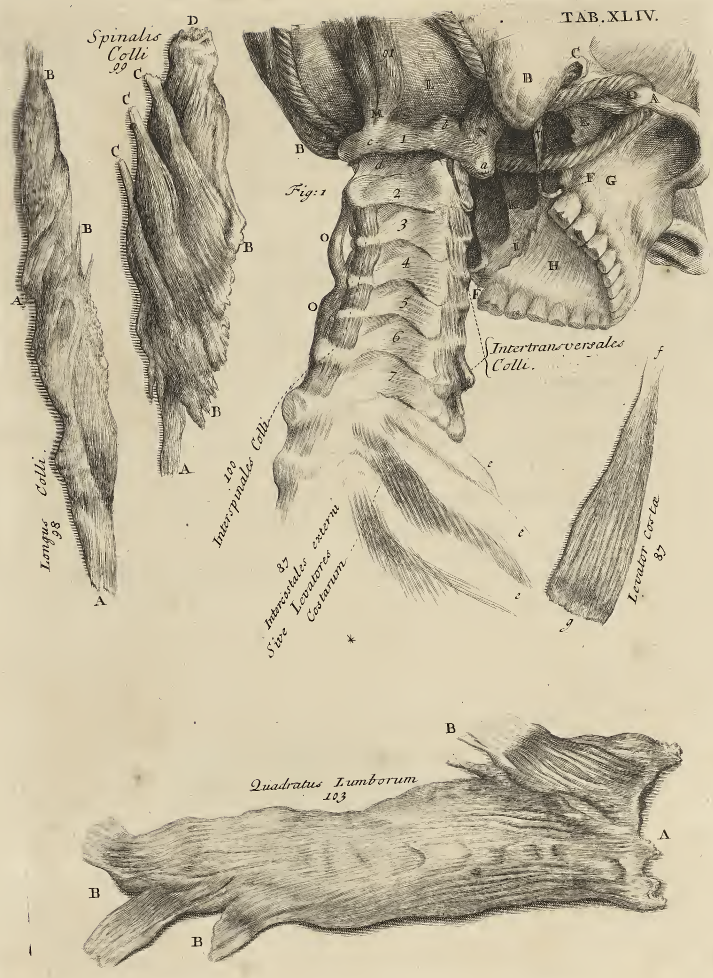
c The back Part of this *Vertebra,* without any Spinal Proceſs.

d A ſtrong, large, but looſe Ligament, between the firſt and ſecond *Vertebræ* of the Neck, ſo framed to give way to the Motion of the firſt *Vertebra,* in turning the Head to either Side.

e, e, e The three upper Ribs.

87 The external Intercoſtal Muſcles, as they appear near the *Vertebræ* of the *Thorax,* where they ariſe from the tranſverſe Proceſſes of the *Vertebræ,* and deſcend obliquely to the upper Part or Margin of each Rib. Theſe Parts of the Intercoſtal Muſcles have by ſome been reckon'd diſtinct Muſcles; but, if you conſider,

TAB. XLIV.


Spinalis Colli 99
Longus Colli. 98
Fig: 1
Intertransversales Colli.
100 Interspinales Colli
87 Intercostales externi Sive Levatores Costarum
Levator Costæ 87
Quadratus Lumborum 103

der, that the *Intercoſtales Externi* have the ſame Direction of Fibres with theſe, and that they are in moſt Places inſeparably intermix'd with each other, there appears no reaſon to multiply the Names of Muſcles in making theſe diſtinct, tho' for the better Explication of the Uſe of that Part, which ariſes from the tranſverſe Proceſs of the *Vertebra*, f, and is implanted in the Rib g, I have inſcrib'd it with the Name of *Levator Coſtæ*, on the Copper Plate.

98 The Inſide of the *Longus Colli*, of the left Side, as big as the Life.

AA The lower tendinous Part, that ſprings from the three ſuperiour *Vertebræ* of the *Thorax*, and three lowermoſt of the Neck.

BB Its tendinous Terminations, cut from the four upper *Vertebræ* of the Neck.

99 The internal Surface of the *Spinalis Colli*, of the left Side, as big as the Life.

ABB Its partly tendinous and partly fleſhy Originations from the five ſuperiour tranſverſe Proceſſes of the *Vertebræ* of the *Thorax*, and inferiour one of the Neck.

C, C, C Three of its Tendons, which terminated in the third, fourth and fifth double Spines of the *Vertebræ* of the Neck.

D Its largeſt Termination, freed from the inferiour part of the ſecond *Vertebra* of the Neck laterally.

100 The *Interſpinales Colli*, as they appear between all the double Spines of the *Vertebræ* of the Neck.

103 The internal Surface of the *Quadratus Lumborum* of the right Side, as big as the Life.

A Its fleſhy Original, from the back part of the Spine of the *Os Ilium*, next the *Os Sacrum*.

BBB Its Terminations, freed from the *Vertebræ* of the Loins, and lower Edges of the two inferiour Ribs.

TAB. XLV.

FIG. I. II.

The exteriour and interiour Surfaces of the Longiſſimus Dorſi, Sacrolumbalis, Sacer, Semi-Spinatus, *and* Tranſverſalis Colli, *diſſected from an emaciated Body.*

A The Origine of the *Sacrolumbalis*, and *Dorſi Longiſſimus*, in common, from the upper part of the *Os Sacrum*, and back part of the Spine of the *Os Ilium*, a a.

b, b, b Divers Terminations of them, on the tranſverſe Proceſſes of the *Vertebræ* of the Loins.

B, B Their tendinous outſide, on the Region of the Loins, from which the Tendons of the *Dorſi Latiſſimus*, and *Serratus Inferior Poſticus*, may be eaſily ſeparated.

C, C, C Some Tendons of the *Longiſſimus Dorſi*, that terminate on the back part of the Ribs.

D, D Two tendinous Slips, ſpringing from the *Longiſſimus Dorſi*, which terminate on the tranſverſe Proceſs of the firſt *Vertebra* of the *Thorax*.

E That part of it, that was inſerted into the lower tranſverſe Proceſſes of the *Vertebræ* of the Neck.

F Another Production of this Muſcle, which, with its Partner on the other Side, is by *Falloppius* called *Par tertium Capitis*, and is implanted on the *Os Occipitis*, behind the *Proceſſus Maſtoides*.

G, G, G The external Parts of the *Sacrolumbalis*, with its tendinous Productions, ariſing fleſhy from the lower Ribs * *, and aſcending obliquely to their Terminations on the upper Ribs.

H, H, H, *h, h* Two or three, of many other Productions of this Muſcle, which, alſo ſpringing from the lower Ribs, aſcend obliquely upwards and inwards, decuſſating the former at acute Angles, as they paſs to their Terminations on the ſuperiour Ribs. *Vid.* Fig. II. ✢✢✢.

101 The exteriour and interiour Surfaces of the *Tranſverſalis Colli*, continued with the upper part of the *Semiſpinatus*.

I Two Productions of this Muſcle, the ſlendereſt and longeſt of which is implanted on the *Occiput*, with the Production of the *Dorſi Longiſſimus*, at F. The other ſhort one is alſo inſerted into the *Os Occipitale*, near the Maſtoide Proceſs.

102 The Body of the *Dorſi Longiſſimus*.

K, K Some fleſhy Fibres, ſpringing from the tendinous outſide of the *Longiſſimus Dorſi*, which aſcending obliquely join with thoſe that lie underneath, and ſpring from the *Vertebræ Dorſi*, expreſs'd at c, c, c, Fig. II. and are afterwards inſerted into the Spines of the *Vertebræ*, d d d, which makes up

104 The

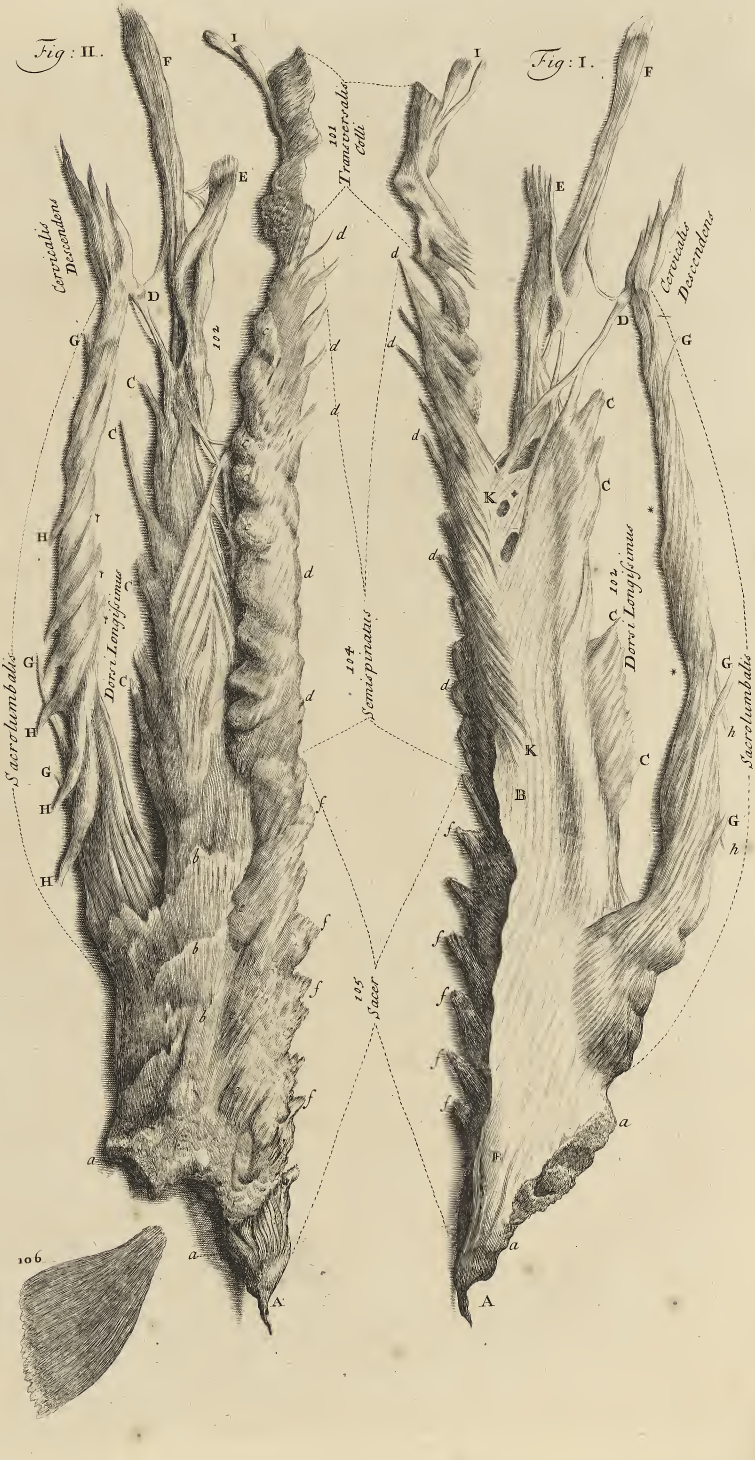
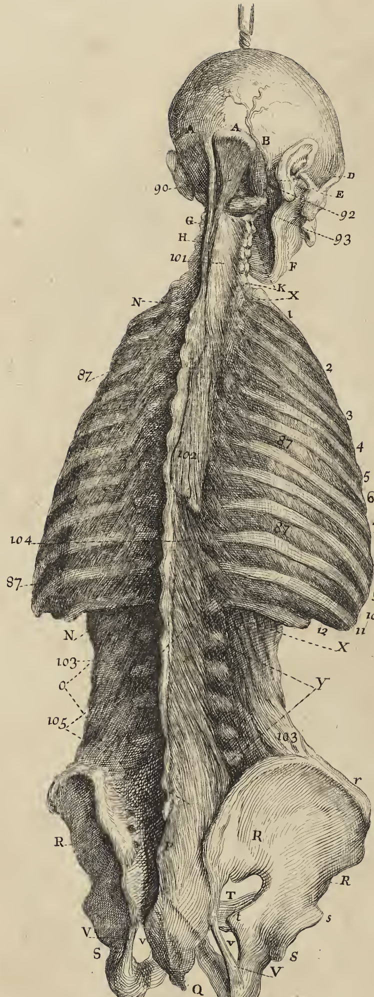
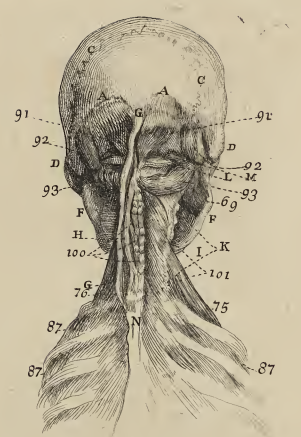


Fig: II.
Fig: I.
101 Transversalis Colli
102
Cervicalis Descendens
Dorsi Longissimus
86 Sacrolumbalis
104 Semispinatus
105 Sacer
106
102 Dorsi Longissimus
Sacrolumbalis 86
Cervicalis Descendens





A, *Os Occipitis*:
B, *Vasa Sanguinea*
C, *Sutura Lambdoides*.
D, *Processus Mammiformis*.
E, *Os Jugale*.
F, *Maxilla inferior*.
G, *Ligamentum Occipitale*.
H, *Musculus Superspinalis Colli*.
I, *Vertebrarum Colli Spinæ bifidæ*.
K, *Processus transversales earundem*.
L, *Primæ Vertebræ colli pars posterior*.
M, *Arteriæ Vertebralis Truncus*.
N, *Vertebrarum Dorsi Spinæ*.
O, ——————— *Lumborum*.
P, ——————— *Ossis Sacri*.
Q, *Os Coccygis*.
R, *Os Ilium*; *r ejus Spina*
S, *Os Ischium*
s, *Supercilium Acetabuli*
t, *Ischij Processus Acutus*
T, *Os Pubis*
v, *Foramen ejus*
V, *Ligamentum quod Tuberculum Ischij cum Osse Sacro conjungit*
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, *Costæ Duodecim*.
X, *Vertebrarum Thoracis Processus Transversi*
Y, ——— *Lumborum Processus Transversi*
102 *Dorsi Longissimi pars*

104 The external and internal Surfaces of the *Semiſpinatus.*

105 The external and internal Surfaces of the *Sacer.*

eee Thoſe Parts of it that ſpring from the *Vertebræ* of the Loins, which aſcend obliquely, and compoſe

fff Divers Digitations, that terminate in the Spines of the *Vertebræ* of the Loins.

TAB. XLVI.

Is ſufficiently explain'd by the References engrav'd on the Plate.

TAB. XLVII.

107 The internal Surface of the *Pectoralis*, of the right Side.

A B Its fleſhy Origination. Here it may be obſerv'd, that the Fibres of the lower Part, B, aſcend and decuſſate thoſe of its upper Part, A, in its broad Tendon, C, inſerted into the *Os Humeri*.

D A Production of the Tendon of the *Pectoralis*, which aſcends and joins the Ligament of the Articulation of the *Os Humeri* with the *Scapula*.

108 The internal Surface of the *Deltoides*, of the right Side.

BC Its tendinous Origine from the *Spina Scapulæ*.

A Its fleſhy one from the *Clavicula*.

D Part of the *Perioſteum*, into which it is inſerted on the *Os Humeri*.

109 The internal Surface of the *Supraſpinatus*.

AA Its fleſhy Original from the *Scapula*.

B Its tendinous Termination on the *Os Humeri*.

110 The Inſide of the *Infraſpinatus*.

AA Its fleſhy Original from the *Scapula*.

B Its tendinous Termination on the *Os Humeri*.

C C Its Arteries fill'd with Wax.

111 The outſide of the *Rotundus Minor*.

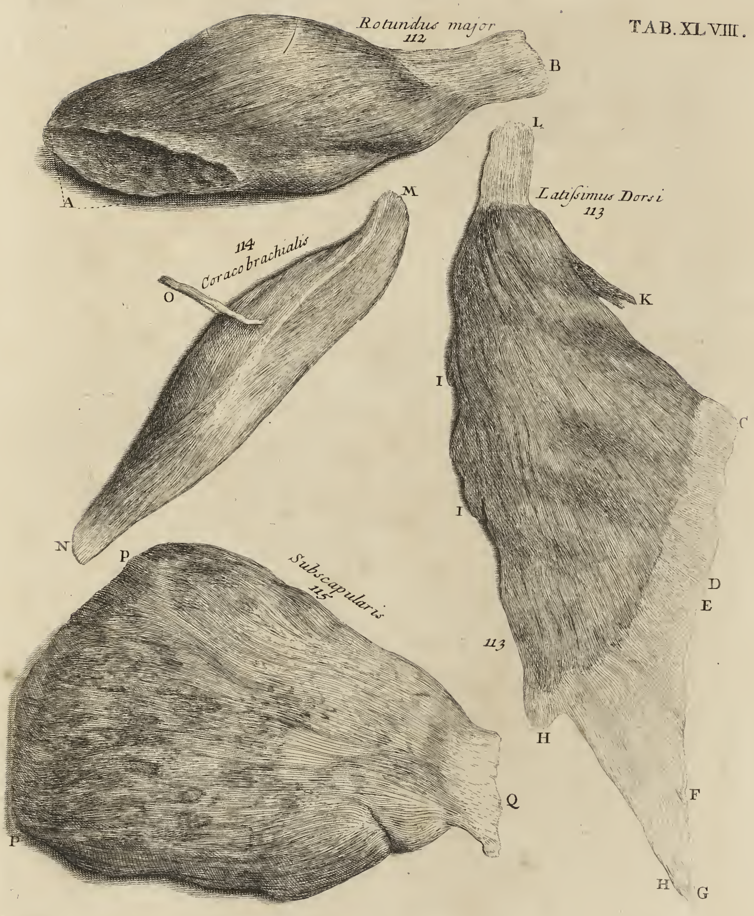
A Its Original from the *Scapula*.

B Its Termination on the *Os Humeri*.

The lower Figure in this Table ſhews the Diſpoſition of the Fibres, as they appear, when the *Infraſpinatus* is divided according to its Length, very much reſembling the Plume of a third or fourth Gooſe-Quill.

TAB. XLVII.

Infraspinatus secundum longitudinem Dissectus


TAB. XLVIII.
Rotundus major
112
B
A
L
M
Latissimus Dorsi
113
114
Coracobrachialis
O
K
I
C
I
N
P
Subscapularis
115
D
E
113
H
Q
F
P
H
G

TAB. XLVIII.

112 The Inſide of the *Rotundus Major.*

A Its fleſhy Original.

B Its tendinous Termination.

113 The internal Surface of the *Latiſſimus Dorſi* of the right Side.

CD Its tendinous Origination from the ſeven inferiour Spines of the *Vertebræ* of the *Thorax.*

EF From thoſe of the Loins.

G From the Spines of the *Os Sacrum.*

HH From the Spine of the *Os Ilium.*

II Its *Faſciculi* of fleſhy Fibres from the Ribs.

K Others from the *Scapula.*

L Its Tendon, at its Inſertion into the *Os Humeri.*

114 The Inſide of the *Coracobrachialis*, as big as the Life.

M Its Origination from the Extremity of the *Proceſſus Coracoides Scapulæ.*

N Its tendinous Inſertion into the middle of the internal Part of the *Os Humeri.*

O The Trunk of the Nerve, that paſſes through this Muſcle.

115 The internal Surface of the *Subſcapularis.*

PP Its fleſhy Origination, freed from the internal concave Part of the *Scapula.*

Q Its Tendon, cut from the *Os Humeri.*

TAB. XLIX.

O The *Clavicula*.

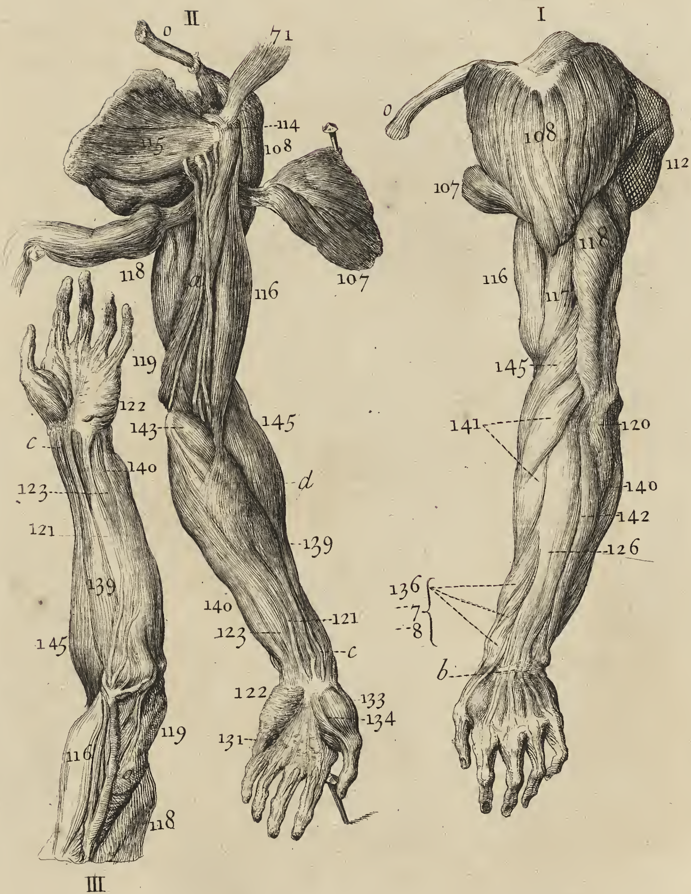
a The Blood Veſſels and Nerves of the Arm.

b The annular Ligament of the *Carpus*.

c The ſuperiour Branch of the Artery, paſſing between the Tendons of the *Supinator Radii Longus*, and *Flexor Carpi Radialis*, which makes the Pulſe in the Wriſt.

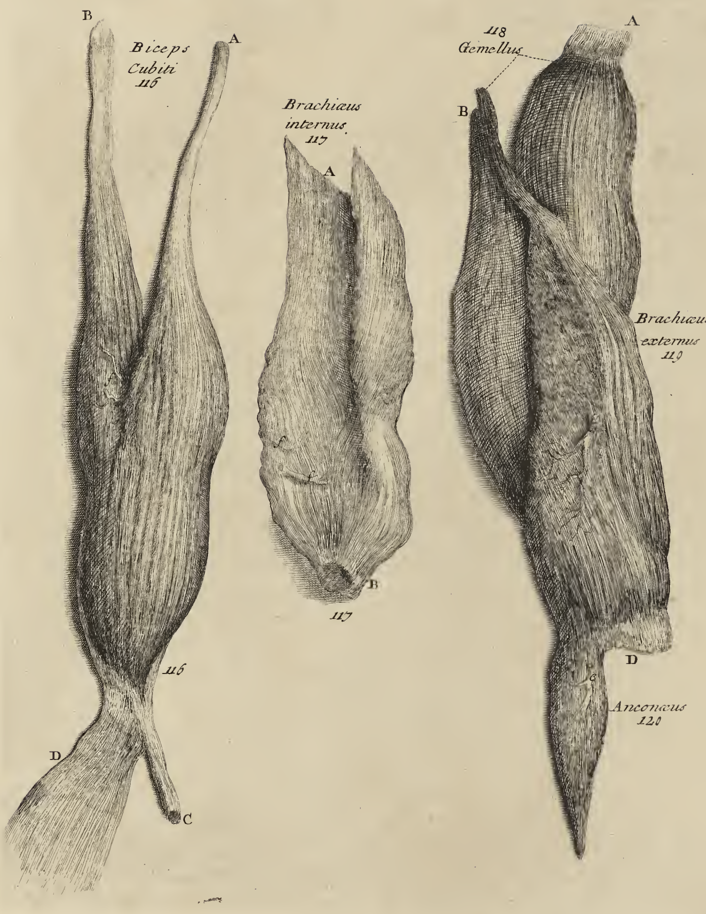
d The tendinous Expanſion of the *Biceps*.

TAB.XLIX.



I
II
III
o
71
114
115
108
107
112
118
116
117
a
119
122
143
145
141
120
c
140
d
123
121
142
139
126
136
7
8
b
133
134
131

TAB. L.


B
Biceps
Cubiti
116
A
Brachiæus
internus.
117
A
B
117
116
D
C
118
Gemellus
A
B
Brachiæus
externus
119
D
Anconæus
120

TAB. L.

116 The inſide of the *Biceps Cubiti* of the right Arm.

A Its external Head, which is a round Tendon ſpringing from the upper part of the *Acetabulum Scapulæ*.

B The internal Head, or beginning, of the *Biceps*, freed from the *Proceſſus Coracoides Scapulæ* and the *Muſculus Coracobrachialis*, to which it adheres.

C The Tendon of the *Biceps*, cut from the Tubercle near the upper end of the *Radius*.

D An other membranous Tendon of this Muſcle, that is expanded with the *Membrana Communis Muſculorum*, and ſtrictly embraces all the external Muſcles of the *Carpus* and Fingers, therefore call'd *Faſcia Tendinoſa*.

f The Blood Veſſels on its inſide.

117 The inſide of the *Brachiæus Internus* of the right Arm.

A Its internal concave Surface, as it ariſes from the *Os Humeri*.

B Its lower part, cut from its Inſertion into the fore part of the *Ulna*.

ff Some Blood Veſſels, creeping on the inſide of this Muſcle next the Bone.

118 The inſide of the *Gemellus* of the right Arm, together with

119 The *Brachiæus Externus*.

120 The *Anconæus*.

A The firſt Head or Beginning of the *Gemellus*, which ſprings with a tendinous Origine from the inferiour *Coſta* of the *Scapula*.

B The ſecond Head of the ſame Muſcle, from the upper and back part of the *Os Humeri*.

C The internal concave Surface of the *Brachiæus Externus*, where it ſprang from the *Os Humeri*, with the Arteries, f, as they appear'd fill'd with Wax.

D The Tendon of theſe Muſcles inſerted into the *Olecranon* or Elbow.

e The Branch of an Artery on the *Anconæus*.

TAB. LI.

121 The *Palmaris Longus.*

A Its Origine, cut from the internal Protuberance of the *Os Humeri.*

B Its membranous Expanſion, freed from the Palm of the Hand.

122 The inſide of the *Palmaris Brevis.*

A A Its Membrane like Tendon, cut from the *Os Metacarpi Minimi Digiti.*

B Its Tendon inſerted into the eighth Bone of the *Carpus.*

123 The internal Surface of the *Perforatus,* and

124 The external Surface of the *Perforans,* with

125 The *Lumbricales,* of the right Hand.

A The beginning of the *Perforatus,* from the internal Extuberance of the *Os Humeri.*

B Part of this Muſcle, which, in this Subject, ſent a ſmall Tendon to the *Perforans.*

CC The Perforations, or Fiſſures, in the Tendons of the *Perforatus,* to tranſmit thoſe of the *Perforans.*

cc Filaments from the Tendons of the *Perforatus.*

D The Original of the *Perforans,* cut from the *Ulna.*

EEE The Tendons of theſe Muſcles, with the *Lumbricales,* cut off from their Inſertions at the reſpective Internodes of the Fingers.

The other Figure ſhews the Muſculi Interoſſei in Situ *with ſome other Muſcles, that appear in the Palm, after the preceding are removed.*

FF The Bones of the Fingers, with their Semicircular Ligaments divided and expanded, after the Tendons CC, c, EE, are taken off.

G The *Ligamentum Tranſverſale Carpi* divided and turn'd out; under which the Tendons leading to the Fingers paſs.

H The Bone of the *Carpus,* from which part of the *Abductor Minimi Digiti* does ariſe.

I That Bone of the *Carpus,* to which the laſt mention'd Bone is connected.

K The Bones of the *Carpus,* where they are articulated with the *Radius.*

L The Bones of the Thumb, connected by their Ligaments.

MMM The three Portions of the *Abductor Minimi Digiti.*

NN The *Interoſſei in Situ.*

O The *Adductor Pollicis.*

P Part of the *Abductor Indicis,* the reſt of it lying under the laſt mention'd Muſcle of the Thumb.

TAB.

TAB. LI.

Palmaris brevis 122
123 Perforatus
124 Perforans
Palmaris longus 121
125 Lumbricales
127
131

TAB. LII.


Minimi digiti extensor
130
Extensor digitorum communis
126
Indicator
128
Abductor Indicis
129
Abductor minimi digiti
131
Interossei
127

TAB. LII.

126 The internal Surface of the *Extenſor Digitorum Communis.*

128 The *Indicator*, and

130 The *Entenſor Minimi Digiti.*

AAA Their ſeveral diſtinct Originations, which are variouſly united in different Subjects, before they come to

BBB Their Inſertions into the Fingers.

CC The *Lumbricales.*

129 The *Abductor Indicis*, as big as the Life.

D Its fleſhy Origine from the *Os Metacarpi* of the fore Finger.

E Its tendinous Ending with the *Indicator.*

131 The *Abductor Minimi Digiti*, as big as the Life.

F One of the Bones of the *Carpus*, from which it takes one of its Origines.

GH Its two other Beginnings.

I The Termination of this Muſcle, cut from the firſt Bone of the little Finger.

127 The ſix *Interoſſei* of the Hand, as big as the Life.

KK Their fleſhy Originations freed from the Metacarpal Bones.

LM Their long Tendons, which ſend Slips to the firſt Internode of each Finger, L. M, their other Parts, which join with the Tendons of the *Extenſor Digitorum Longus*, in the manner expreſs'd in the following Figure.

1, 2, 3 The firſt, ſecond, and third Internodes of the Finger, with its extending Tendons.

O Part of one of the *Lumbricales.*

PP Parts of the *Interoſſei*, on both ſides.

Q The Tendon of the *Extenſor Digitorum Longus.*

q Its two Slips, that are inſerted into the upper part of the firſt *Internodium.*

m The Fibres of the Tendons of the *Interoſſei*, joining with the *Extenſor Digitorum Longus.*

l The Slip ſent off to the firſt Joint of the Finger.

R Part of one of the Bones of the *Metacarpus.*

TAB. LIII.

132 *Flexor Pollicis Longus.*

A One of the Beginnings of this Muſcle, (which is not commonly found) from the internal Protuberance of the *Os Humeri.*

a Its ſecond Beginning from the *Radius.*

B Its Tendon, ending in the ſuperiour part of the third Bone of the Thumb.

133 The *Abductor Pollicis.*

A Its fleſhy Origination from the *Os Carpi*, to which the Thumb is articulated, and the *Ligamentum Tranſverſale Carpi.*

B Its tendinous Ending at the ſuperiour and external part of the ſecond Bone of the Thumb laterally.

C A Tendon we commonly meet with, ſent to this Muſcle from the *Extenſor Primi Internodii Pollicis.*

134 The *Flexor Primi & Secundi Oſſis Pollicis*, as big as the Life.

AAA Its three fleſhy Beginnings, from the *Ligamentum Tranſverſale Carpi*, Bones of the *Carpus*, and *Os Metacarpi* of the middle Finger.

B Its Tendon, inſerted into the firſt and ſecond Bone of the Thumb.

CC Two *Oſſa Seſamoidea* in its Tendon.

135 The *Adductor Pollicis*, as big as the Life.

A Its fleſhy Origination from the *Os Metacarpi Indicis.*

B Its Tendon, inſerted into the ſuperiour part of the firſt Bone of the Thumb.

136 The *Extenſor Primi Oſſis Pollicis.*

A Its Origination from the *Ulna.*

B Its two Tendons, as they appear'd in this Subject, one of which ſent a Slip, C, to the *Abductor Pollicis*, before they were both inſerted into the lower part of the firſt Bone of the Thumb.

137 The *Extenſor Secundi Oſſis Pollicis.*

A Its fleſhy Origine from the *Radius.*

B Its Tendon, ending in the lower part of the ſecond Bone of the Thumb.

138 The *Extenſor Tertii Oſſis Pollicis.*

AA Its broad, partly tendinous, but chiefly fleſhy, Origination from the *Ulna.*

B Its Tendon, cut from the lower part of the third Bone of the Thumb.

139 The *Flexor Carpi Radialis.*

A Its Origination.

B Its Inſertion.

140 The *Flexor Carpi Ulnaris.*

A Its tendinous Beginning from the internal Extuberance of the Shoulder Bone.

BB From the *Ulna.*

C Its Tendon, inſerted into the fourth Bone of the *Carpus*, and the *Os Metacarpi* that ſuſtains the little Finger.

141 The inſide of the *Extenſor Carpi Radialis.*

Flexor Pollicis longus 132
135 Adductor Pollicis
Flexor brevis sive 1mi & 2di Ossis Pollicis Flexor 134
Abductor Pollicis 133
Extensor 1mi Ossis Pollicis 136
Extensor 2di Ossis Pollicis 137
Extensor 3tii Ossis Pollicis 138
Flexor Carpi Radialis 139
Extensor Carpi Radialis 141
Extensor Carpi Ulnaris 142
Flexor Carpi Ulnaris 140

A The outermoſt Head, which ſprings fleſhy from above the external Protuberance of the *Os Humeri.*

B The innermoſt Beginning of this Muſcle, which ariſes from the *Os Humeri* below the former, as alſo from the upper part of the *Radius.*

C C Their two Tendons, that end in the ſuperiour Parts of the *Oſſa Metacarpi* of the fore and middle Fingers.

142 The *Extenſor Carpi Ulnaris.*

A Its Origination from the outward Extuberance of the *Os Humeri.*

B Its Tendon, inſerted into the ſuperiour part of the Metacarpal Bone of the little Finger.

TAB. LIV.

143 The Inſide of the *Pronator Radii Teres,* as big as the Life.

A Its firſt Original from the internal Extuberance of the *Os Humeri.*

B The ſecond from the *Ulna.*

C Its tendinous Inſertion freed from the *Radius.*

144 The Inſide of the *Pronator Radii Quadratus,* as big as the Life.

A Its tendinous Origine from the *Ulna.*

B Its fleſhy Termination on the *Radius.*

145 The Inſide of the *Supinator Radii Longus.*

A Its broad fleſhy Origination from the *Os Humeri.*

B Its Tendon, ending in the lower and internal part of the *Radius.*

146 The Inſide of the *Supinator Radii Brevis,* as big as the Life.

A Its Origine from the ſuperiour and external part of the *Ulna.*

B Its Inſertion into the Body of the *Radius.*

147 The *Pſoas Parvus.*

A Its Origination.

B Its Termination.

148 The external Surface of the *Pſoas Magnus,* with the internal Surface of the *Iliacus Internus,* to which it is inſeparably joined.

A A Its Original from the *Vertebræ* of the Loins.

B Its Termination, which is partly tendinous and partly fleſhy, at the inferiour part of the leſſer *Trochanter* of the Thigh-bone.

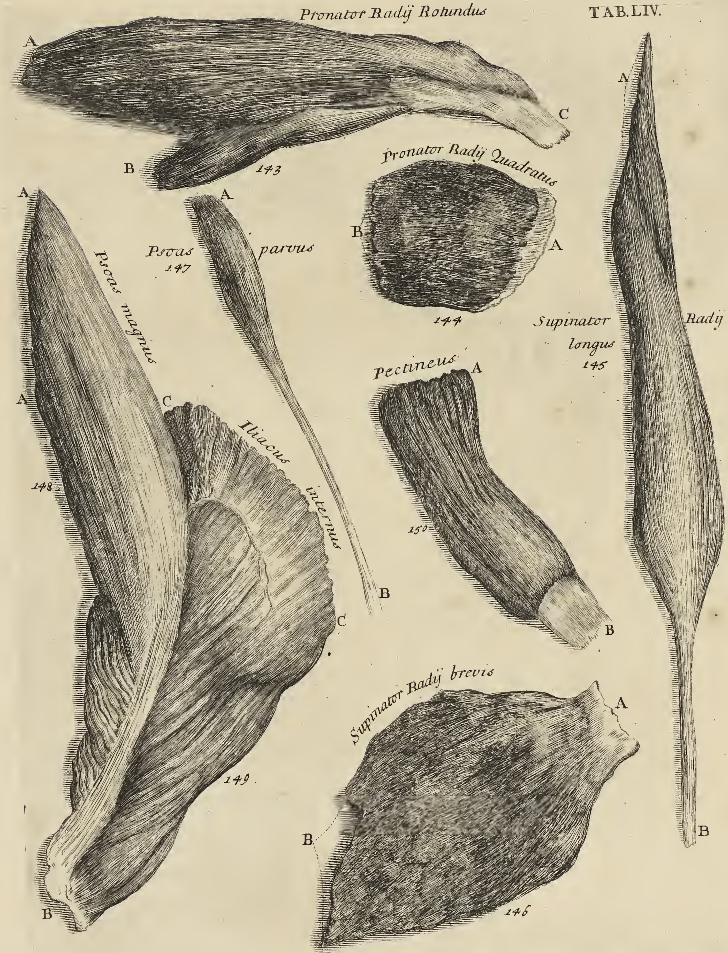
149 The *Iliacus Internus.*

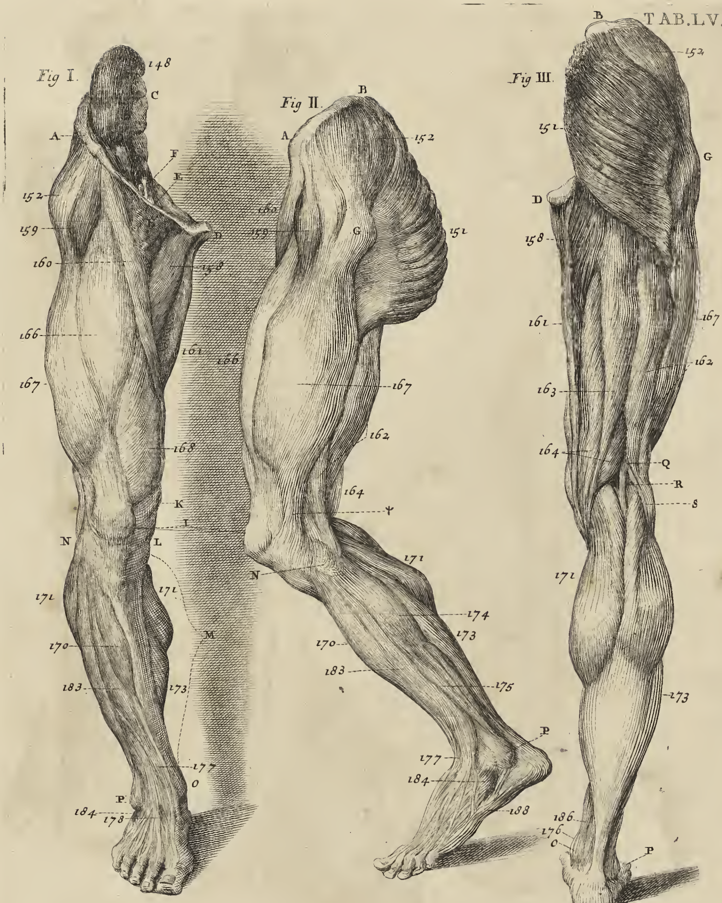
C C Its fleſhy Origine from above half the ſuperiour internal concave Part of the *Os Ilium.*

150 The *Pectineus.*

A Its fleſhy Original from the *Os Pubis.*

B Its tendinous Ending on the *Os Femoris.*


Pronator Radij Rotundus
A
B
C
143
Pronator Radij Quadratus
B
A
144
Supinator longus 145
Radij
A
B
Psoas 147
parvus
A
B
Psoas magnus
Iliacus internus
A
A
C
C
148
149
B
Pectineus
A
150
B
Supinator Radij brevis
A
B
146



A B *Spina sive Appendix ossis Ilium*
C *Ossis Ilium sedes posterior ab osse sacro divulsa.*
D *Os Pubis*
E *Obliqui descendentis Tendinis portio*
F *Arteriæ & Venæ Cruralis Trunci*
G *Trochanter major*
H *Glandula inguinalis*
I *Patella*
K *Ossis Femoris Appendix inferior*

L *Appendix superior Ossis Tibiæ*
M *Os Tibia.*
Ψ *Membranosi Tendo*
N *Fibulæ Appendix superior*
O *Malleolus Internus*
P *Malleolus Externus*
Q *Divisio Nervi Cruralis*
R *Ramus interior ac crassior*
S *Ramus exterior ac minor.*

FIG. LVI.

A.B. *Ossis Ilij Spina.*
a. *Nervus Cruralis.*
b. *ejus Ramus interior & major.*
c. *Ramus minor.*
d. *Arteriæ & Venæ Cruralis Truncus.*
e *Arteriæ Venæ Nerviq; Truncus.*
C. *Ossis Ilij Sinus inæqualis Osse Sacro liberatus.*
D. *Os Pubis.* E. *ejus Foramen.*
F. *Processus acutus Coxendicis.*
G. *Sinus Coxendicis pro Mus*[li] *Pyriformis transitu.*
g. *Appendix Coxendicis.*

H. *Ligamentum latum apertum ad exhibendum h.*
h. *Ossis Femoris Caput.*
i. *Ligamentum Osse Sacro dissectum.*
I. *Patella.*
K. *Trochanter major.*
L.L. *Os Femoris.* l. *ejus Linea Aspera*
M.M. *Capita Appendicis inferioris.*
N. *Os Tibia.* O. *Malleolus internus.*
P: p. *Fibula.* P. *Malleolus externus.*
Q. *Os Calcis.*

TAB. LV. LVI.

Need no other Explication than the References engrav'd at the bottom of the Plates, and the general Syllabus *of the Muscles.*

TAB.

TAB. LVII.

151 The Inſide of the *Glutæus Magnus* of the left Side, together with its lateral Tendon, which is joined with the Tendon of the *Muſculus Membranoſus*.

AA Its tendinous Origine from the Spine of the *Os Ilium*.

BB The fleſhy Origine of this Muſcle, from the Spine of the *Os Ilium*, *Os Sacrum* and *Os Coccygis*.

CC The great tendinous Termination of this Muſcle, cut from the *Linea Aſpera* of the *Os Femoris*.

D The other broad Tendon of this Muſcle, which is united with the Tendon of the *Membranoſus*.

159 The *Membranoſus*, cut from its fleſhy Origine at the fore part of the Spine of the *Os Ilium*.

EE Part of its membranous Expanſion, together with that of the *Glutæus*, freed from the Muſcles of the Thigh.


TAB. LVII.
B A
A
151
159
Membranosus
B
D
C
Glutæus
magnus
151
C
E
E
159
E


Glutæus medius
152
A
A
C
152
B
Pyriformis
F
154
F
G
Glutæus minimus
153
D
D
E
L
Marsupialis
H
K
I
K
155
H
Obturator externus
O
O
157
P
Quadratus Femoris
156
M
N

TAB. LVIII.

152 The Infide of the *Glutæus Medius* of the left Thigh.

A A Its Original, cut from the Spine of the *Os Ilium.*

B Its fhort ftrong Tendon, cut from the fuperiour and external part of the great *Trochanter.*

C The Trunk of an Artery with its Branches fill'd with Wax.

153 The external Surfaces of the *Glutæus Minimus*, and

154 The *Pyriformis*, with

155 The *Marfupialis*, together with its *Marfupium*, of the left Thigh.

D D The Origination of the *Glutæus Minimus* from the back part of the *Os Ilium.*

E Its Tendon, freed from its Implantation into the fuperiour part of the Root of the great *Trochanter.*

F F The Origine of the *Pyriformis* from the *Os Sacrum*, in the *Pelvis* of the *Abdomen.*

G Its Tendon, cut from its Infertion into the Root of the *Trochanter*; where it is joyn'd to the Tendon of the *Marfupialis.*

H H The Origine of the *Marfupialis* from the *Os Ilium*, *Ifchium* and *Pubis.*

I Its Tendons, that pafs the *Sinus* of the *Ifchium.*

K K Its *Marfupium* open'd, to fhew the Progrefs of its Tendon.

L The Tendon of the *Marfupialis*, cut from the Root of the great *Trochanter.*

156 The *Quadratus Femoris.*

M Its Origine from the *Ifchium.*

N Its Termination at the pofteriour part of the *Os Femoris*, below the great *Trochanter.*

157 The external Surface of the *Obturator Externus.*

O O Its Origine from the *Os Ifchium*, and *Pubis.*

P Its Tendon inferted at the Root of the great *Trochanter.*

Q A Blood Veffel on its outfide.

TAB. LIX.

158 The Inſide of the *Triceps* of the left Thigh.

A The firſt deſcrib'd Head, and largeſt beginning of the *Triceps*, that ſprings from the *Os Iſchium* and *Pubis*.

B The ſecond Head, or tendinous beginning of it, cut from the *Os Pubis*.

C The third beginning of the *Triceps*.

D Its ſtrong round Tendon, cut from the upper part of the lower *Appendix* of the Thigh Bone.

EE The Tendon of the *Triceps*, freed from its Inſertion into the *Linea Aſpera* of the Thigh Bone.

160 The *Sartorius*.

F Its Origine from the Spine of the *Os Ilium*.

G Its Termination on the *Tibia*.

161 The Inſide of the *Gracilis*.

HH Its broad tendinous Origine from the *Os Pubis*.

I Its Termination on the *Tibia*.

TAB.LIX.

TAB. LX.


Biceps femoris
A
B
162
C
Semi- -nervosus, s.
Semi- -tendinosus
D
163
E
Semimembra- -nosus
F
164
G
H
Popliteus
K
165
I

TAB. LX.

162 The external Surface of the *Biceps* of the left Thigh.

A The ſuperiour Head of this Muſcle, which is a round Tendon, cut from the Protuberance of the *Os Iſchium*.

B The lower Head of the *Biceps*, cut from the *Linea Aſpera* of the Thigh Bone.

C Its Tendon, ending on the ſuperiour *Epiphyſis* of the *Fibula*.

163 The outſide of the *Seminervoſus*, or *Semitendinoſus*, of the ſame Thigh.

D Its tendinous and fleſhy Origine from the *Iſchium*.

E Its Tendon, in this Subject divided, at its Inſertion into the *Tibia*.

164 The outſide of the *Semimembranoſus* of the right Thigh.

F Its flat tendinous Origine cut from the *Iſchium*.

G An Impreſſion, made in this Muſcle, by the Tendon of the *Seminervoſus* paſſing over it.

H Its Tendon, cut from its Termination on the ſuperiour part of the upper *Appendix* of the *Tibia*.

165 The inſide of the *Popliteus*.

I Its tendinous Origine, from the external Head of the inferiour *Appendix* of the *Os Femoris*.

K Its fleſhy Termination, cut from the *Tibia*.

TAB.

TAB. LXI.

166 The internal Surface of the *Rectus Femoris.*

A That part of its Origine, that ſprings from the Margin of the *Acetabulum.*

B The other part of its Origine, from a Tubercle under the Spine of the *Os Ilium.*

167 The internal Surface of the *Vaſtus Externus.*

168 The internal Surface of the *Vaſtus Internus.*

169 ———————————— *Crureus.*

C The Branches of an Artery, on the internal Surface of the *Crureus,* next the *Os Femoris.*

D A Tranſverſe Order of Fibres, between the two *Vaſti* on the *Crureus.*

E The Tendon of the *Crureus,* joyn'd with thoſe of the two *Vaſti.*

F G The mucilaginous Glands on theſe Tendons, above and below the *Patella.*

H The internal Surface of the *Patella.*

I The Termination of all theſe extending Muſcles of the Leg, cut from the *Tibia.*

170 The internal Surface of the *Tibialis Anticus.*

K Its upper fleſhy Part, cut from the *Tibia.*

L Its Tendon, or lower Part, cut from the *Os Cuneiforme Majus,* and *Os Metatarſi* of the great Toe.

TAB.LXI.


A
B
Rectus Femoris
166
Crureus
169
K
Tibialis anticus
Vastus externus
168
Vastus internus
D
167
E
F
170
H
G
L
I

TAB.LXII.


Gasterocnemius
171
A
B
C
E
Plantaris
172
F
D
D
K
173
Peroneus primus
M
Tibialis posticus
R
P
Peroneus
175
secundus
Soleus
173
174
176
175
F
S
T
N
V
I
X
L
G
H
172
O
Q

TAB. LXII.

171 The Inſide of the *Gaſterocnemius*, or *Gemellus*, of the right Leg, together with the *Plantaris* and *Soleus*.

A That Part of the *Gaſterocnemius*, which ariſes from the external Tubercle of the Thigh Bone.

B Its other Beginning from the internal Tubercle of the ſame Bone.

C Some Trunks of Arteries fill'd with Wax, paſſing into this Muſcle.

DD The internal tendinous Surface of this Muſcle, next the external Tendon of the *Soleus*, by which theſe Muſcles are render'd more apt to ſlide on each other, when they act.

172 The *Plantaris*.

E Its Original from the external Tubercle of the *Os Femoris*.

FF Its long flat Tendon, reſembling a narrow Satin Riban, paſſing between the *Gaſterocnemius* and *Soleus*.

G Its tendinous Expanſion, freed from the bottom of the Foot.

H The tendinous Expanſion, that ſprings from the *Os Calcis*.

I That part of it, that terminated in the lower Parts of the *Oſſa Metatarſi*, and the firſt Bones of the Toes.

173 The internal Surface of the *Soleus*, or *Gaſterocnemius Internus*.

K Its tendinous and fleſhy Origine from the upper *Appendix* of the *Fibula*.

L The Tendons of this and the *Gaſterocnemius Externus*, at their united Inſertion into the *Os Calcis*.

174 The inſide of the *Peronæus Primus* of the right Leg.

M Its fleſhy Fibres, cut from their Original at the ſuperiour part of the *Fibula*.

N A ſmall cartilaginous Body in the bending of the Tendon of this Muſcle, as it paſſes on the *Os Cuboides*, from whence it runs to the bottom of the Foot.

O Its Termination on the *Os Metatarſi* of the great Toe.

175 The outſide of the *Peronæus Secundus*.

P The upper Part, which ſprings from the *Fibula*.

Q Its tendinous Ending, cut from the *Os Metatarſi* of the little Toe.

176 The outſide of the *Tibialis Poſticus*, of the ſame Leg with the former.

R Its upper Part, that ſprings from the *Fibula*.

S That Part of its Tendon, which in old Bodies grows hard and bony, but in this Subject, who was young, did not appear ſo. This ſlips up and down, not unlike the *Patella* placed in the Tendons of the extending Muſcles of the *Tibia*, whereby theſe Tendons are defended from any Attrition on the Bones they paſs over.

T V Its tendinous Fibres, that terminate in the *Os Naviculare*.

X The ſtrong Tendon, that terminates in the *Os Cuneiforme Majus*.

TAB. LXIII.

The Muſcles of the Toes.

177 The underſide of the *Extenſor Pollicis Longus* of the right Foot.

A A Its diſgregated fleſhy Original from the *Fibula.*

B Its Tendon cut from the upper part of the ſecond Bone of the great Toe.

178 The *Extenſor Pollicis Brevis* of the ſame Foot.

C Its Origine from the ſuperiour and fore part of the *Os Calcis.*

D Its tendinous Ending, cut from the firſt Bone of the great Toe.

179 The external Surface of the *Flexor Pollicis Longus.*

E Its acute fleſhy Original from the back part of the *Fibula.*

e A Slip from the Tendon of this Muſcle, going to the Tendons of the *Perforans,* as it paſſes the bottom of the Foot.

F The broad Extremity of its Tendon, cut from the laſt Bone of the great Toe.

183 The exteriour Surface of the *Extenſor Digitorum Longus.*

L L Its long fleſhy Original from the upper *Appendix* of the *Tibia,* and fore part of the *Fibula.*

m One of its Tendons, cut from the ſuperiour part of the *Os Metatarſi* of the little Toe.

llll Its four Tendons freed from the ſuperiour Part of the third Bones of the four leſſer Toes.

184 The *Extenſor Digitorum Brevis.*

N Its fleſhy Origine from the external and fore part of the *Os Calcis.*

oooo Its four Tendons, which join with the former, near their Inſertions into the third Bones of the Toes.

185 The outſide of the *Flexor Digitorum Perforatus.*

I Its fleſhy Original from the *Os Calcis.*

kkkk Its four Tendons, (after being ſplit, or perforated, to tranſmit the Tendons of the *Perforans)* cut from their Terminations on the ſecond Bone of each leſſer o e.

186 The outſide of the *Flexor Digitorum Perforans.*

G Its acute fleſhy Original from the back part of the *Tibia.*

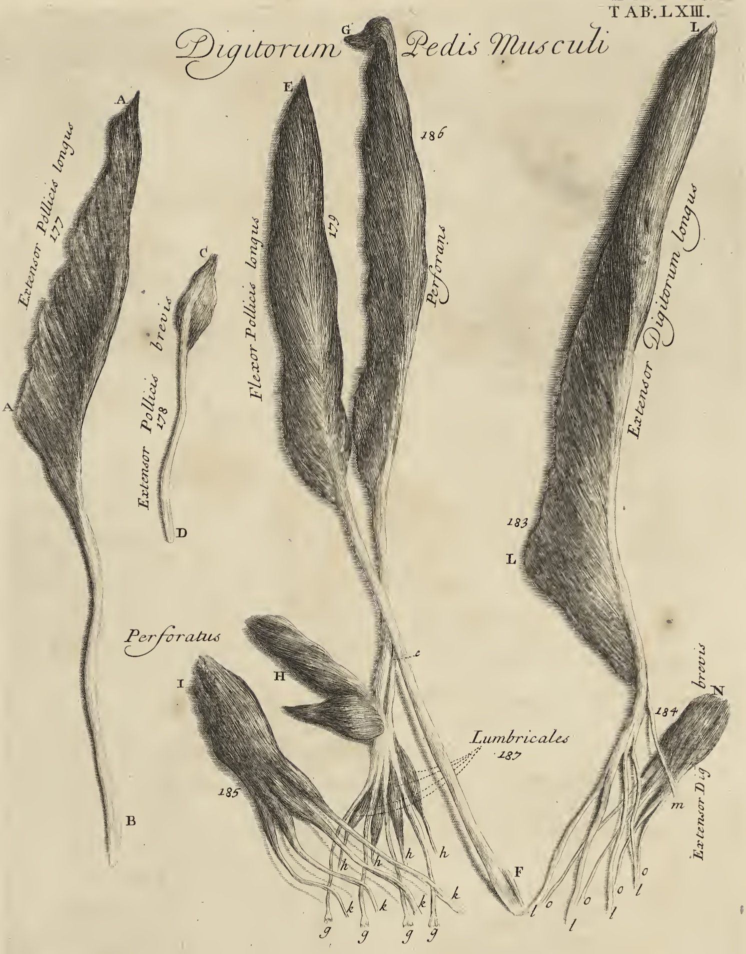
gggg Its Tendons, cut from the third Bone of each leſſer Toe.

187 The *Lumbricales.*

H Their fleſhy Original from the internal part of the *Os Calcis.* This is commonly call'd *Carnea Maſſa in Planta Pedis.*

hhhh Their four Tendons, ſpringing from their four fleſhy Parts, and terminating on the inſide of the four leſſer Toes.

TAB. LXIII.


Digitorum Pedis Musculi
Extensor Pollicis longus
177
Extensor Pollicis brevis
178
Flexor Pollicis longus
179
Perforans
186
Extensor Digitorum longus
183
Perforatus
185
Lumbricales
187
Extensor Dig brevis
184
A
A
B
C
D
E
G
H
I
L
L
N
F
e
m
h h h h
k k k k
g g g g
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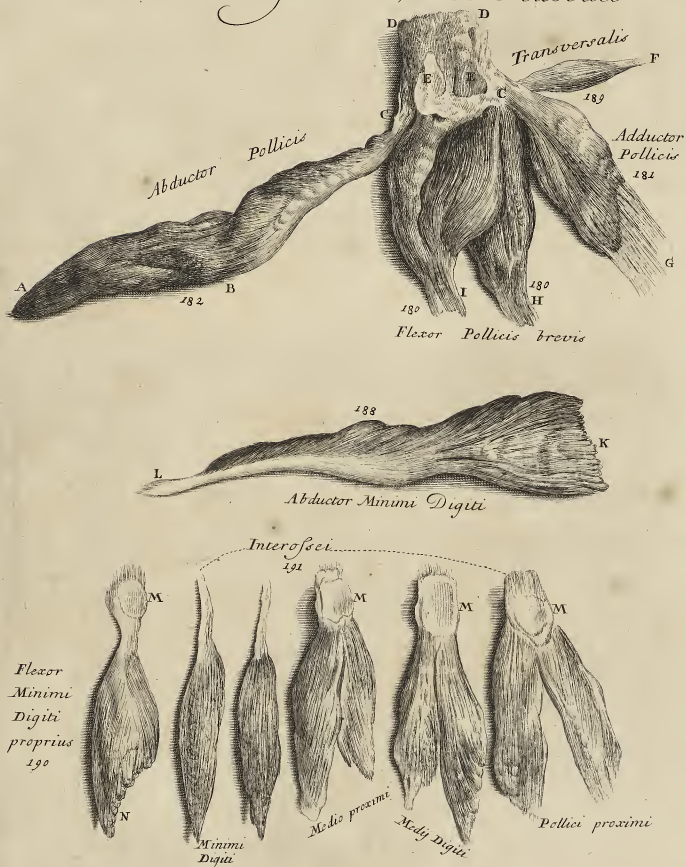
TAB.LXIV.

Digitorum Pedis Musculi



TAB. LXIV.

The Muſcles of the Toes, as big as the Life.

180 The internal Surface of the *Flexor Pollicis Brevis.*

H I Its two Beginnings in this Subject, from the *Os Cuneiforme Medium.*

181 The internal Surface of the *Adductor Pollicis.*

G Its broad tendinous Beginning, cut from the *Os Calcis.*

C Its Tendon inſerted into the internal *Os Seſamoideum,* E.

182 The *Abductor Pollicis.*

A Its firſt deſcribed fleſhy Beginning from the *Os Calcis.*

B The ſecond, from the *Os Cuneiforme Majus.*

C Its Tendon, inſerted into the external ſide of the firſt Bone of the great Toe.

EE The *Oſſa Seſamoidea.*

DD The Terminations of the laſt mention'd Muſcles, cut from the firſt Bone of the great Toe.

188 The external Surface of the *Abductor Minimi Digiti.*

K Its fleſhy Original from the *Os Calcis.*

L Its Tendon, cut from the firſt Bone of the little Toe.

189 The *Tranſverſalis Pedis,* left at its Original from the *Os Seſamoides* of the great Toe.

F Its Termination, cut from the Cartilage of the firſt Articulation of the Toe next the little Toe, as well as that of the little Toe it ſelf.

190 The internal Surface of the *Flexor Minimi Digiti Proprius.*

N Its Original from the *Os Metatarſi Minimi Digiti.*

M Two *Oſſa Seſamoidea* in the Tendon of this Muſcle, before it is inſerted into the firſt Bone of the little Toe.

191 The eight *Muſculi Interoſſei.*

MMM The *Oſſa Seſamoidea* in their Tendons.

TAB. LXV.

For the better explaining the Muscles on the Bottoms of the Feet, they are represented in the two following Tables, as they appear'd in the Dissection of the right Foot.

FIG. I. II.

The first shews the Appearance of the Bottom of the Foot, after the Skin and Fat is removed.

The second represents the external Tendons and Muscles dissected and display'd, to shew those under them in their natural Situation.

AA The *Os Calcis.*

BB Part of the *Malleolus Internus.*

C Fig. I. Part of the *Malleolus Externus.*

D D The superiour and external part of the *Os Metatarsi Minimi Digiti.*

EE One of the *Ossa Sesamoidea* of the great Toe.

FF Fig. I. A transverse Ligament, which tyes the first Internodes of all the little Toes together.

GGG Fig. II. The Chanels, which are invested with Ligaments, that enclose the Tendons employ'd in bending the Toes.

172 The Tendon of the *Plantaris* as it appears on the bottom of the Foot, in its natural Situation, Fig. I.

The same raised and left to the *Os Calcis,* Fig. II.

1 Its Original from the *Os Calcis.*

111 Its Termination freed from the first Internodes of the lesser Toes.

180 *Flexor Pollicis Brevis,* Fig. II.

182 The *Abductor Pollicis in Situ,* Fig. I.

Rais'd from its Origine, Fig II.

3 That part of the *Abductor Pollicis,* that arises from the *Os Cuneiforme Majus.*

13 Fig. II. *V.* Tab. *66.* *

188 The *Abductor Minimi Digiti in Situ,* Fig. I.

Left at its Termination, Fig. II.

187 Fig. II. The *Carnea Massa in Planta Pedis,* which I take to be the true Original of the *Lumbricales.*

10 10 10 The *Musculi Lumbricales,* commonly so called.

4 The Tendon of the *Flexor Pollicis Pedis Longus,* lying under the Tendon of the *Perforans.*

186 The Tendon of the *Perforans,* to which the *Carnea Massa,* or *Musculi Lumbricales* adhere, soon after it crosses the *Flexor Pollicis Longus.*

185 The

TAB.LXV.

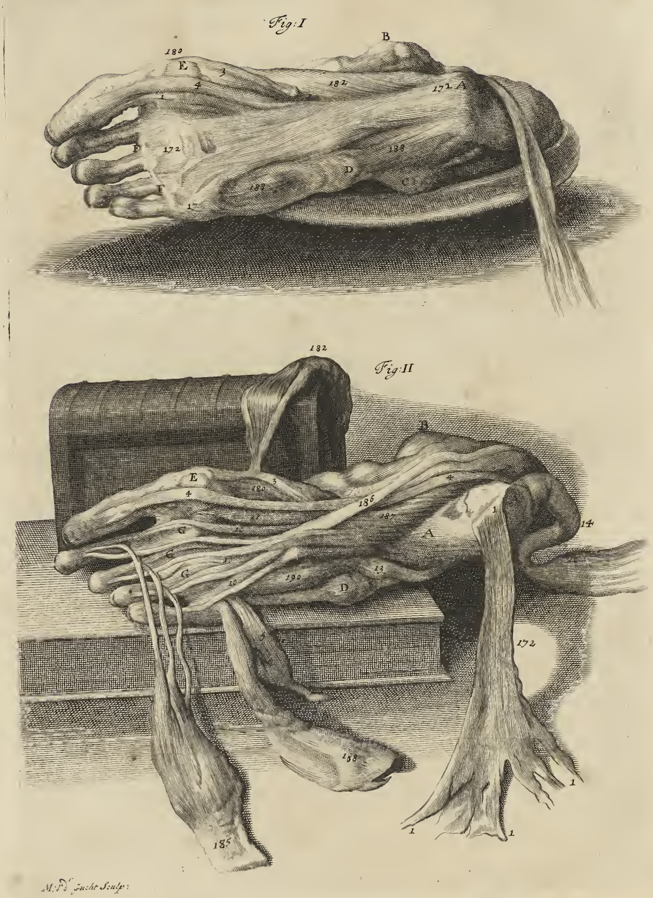


Fig: I
B
180
E
3
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182
172 A
172
188
D
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Fig: II
182
B
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185 The *Perforatus* raiſed from its Origine at the *Os Calcis*, and turned down. In this Subject there were but three Tendons from this Muſcle, to three of the Toes only; but in others we commonly find four, inſerted in to the ſecond Internodes of each leſſer Toe.

14 Fig. II. The Tendon of the *Gaſterocnemii*, *&c.*

190 *Flexor Primi Internodii Minimi Digiti Proprius in Situ.*

5 The external *Interoſſeus*, improperly ſo call'd, of the little Toe.

1 Fig. I. The Tendon of the *Adductor Pollicis.*

11 Fig. II. The *Adductor Pollicis in Situ.*

TAB. LXVI.

FIG. I. II.

AA The *Os Calcis.*

BB The *Malleolus Internus.*

CC A Prominence in the *Os Cubiforme,* cover'd wirh a Cartilage, that is receiv'd by a ſmall moving Cartilage, placed in the Tendon of the *Peronæus Longus.* * 174.

D A Furrow or Chanel, in the *Os Calcis,* in which paſſes the Tendon of the *Flexor Pollicis Longus.*

E Another Chanel, party on the *Os Calcis,* and partly on the *Aſtragalus,* for the Tendon of the *Flexor Digitorum Perforans.*

F Fig. II. The *Os Metatarſi* of the great Toe.

G *Ibid.* Its ſmooth cartilaginous *Appendices,* on which the *Oſſa Seſamoidea,* h, h, placed in the Tendon of the *Flexor Pollicis Brevis,* move.

H *Ibid.* The Surface of the *Os Cuneiforme Majus,* to which the *Os Metatarſi* of the great Toe is articulated.

i i i i *Ibid.* The four *Oſſa Metatarſi* of the little Toes.

176. *Ibid.* Part of the *Tibialis Poſticus,* next its Inſertion into the *Os Cuneiforme Majus.*

174 *Ibid.* The Tendon of the *Peronæus Primus,* left at its Termination on the *Os Metatarſi* of the great Toe, F.

180 *Ibid.* The *Flexor Pollicis Brevis.*

181 *Ibid.* The *Adductor Pollicis.*

191 The *Interoſſei.*

10 10 10 Fig. I. The *Adductor Pollicis.*

8 Fig. I. The Tendon of the *Tibialis Anticus,* at its Termination.

2 *Ibid.* The *Os Cuneiforme Majus.*

9 *Ibid.* A riſing of the *Os Calcis,* next the *Aſtragalus.*

5, 6 *Ibid.* The internal Surface of the *Lumbricales,* and that part of them call'd *Carnea Maſſa,* united with the Tendons of the *Perforans* in the *Planta Pedis.*

179 *Ibid.* The *Flexor Pollicis Longus.*

♀ Its tendinous Slip to the *Perforans.*

186 The *Perforans.*

8 F. II. The Tendon of the *Peronæus Secundus.*

FINIS

TAB. LXVI.


Fig: II.
A
B
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176
174
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Fig: I.
B
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